FISH CREEK RESERVOIR EXPANSION

DRAFT ENVIRONMENTAL IMPACT STATEMENT

ROUTT NATIONAL FOREST
29587 West U.S. 40, Suite 20
Steamboat Springs, CO 80487

February 1993

FISH CREEK RESERVOIR EXPANSION
DRAFT ENVIRONMENTAL IMPACT STATEMENT

FEBRUARY 1993

ROUTT NATIONAL FOREST
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STEAMBOAT SPRINGS, CO 80487

United States Department of Agriculture | Forest Service | Routt National Forest | 29587 W. US 40, Suite 20
Steamboat Springs, Colorado 80487
303 879-1722

Reply to: 1950-3

Date: February 16, 1993

Dear Reader:

Enclosed is the Fish Creek Reservoir Draft Enviromental Impact Statement (DEIS) for the proposed enlargement of the Fish Creek Reservoir by the City of Steamboat Springs and Mt. Werner Water & Sanitation District. This DEIS is being circulated for your review and comment. The formal comment period ends on April 12, 1993. Written comments may be sent to:

Jerry E. Schmidt, Forest Supervisor
Routt National Forest
29587 West U.S. Highway 40, Suite 20
Steamboat Springs, CO 80487
(303) 879-1722

A public meeting will be scheduled during the 45-day comment period to receive comments after the public has had an opportunity to review the DEIS. Notice of that meeting will be published in the Steamboat Pilot.

Should you have any questions, please contact Wendy Schmitzer at the telephone number above.

Sincerely,

Jerry E Schmidt

JERRY E. SCHMIDT
Forest Supervisor

cc: S.Reed:HP
K.Kowynia:HP
W.Schmitzer

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED FISH CREEK RESERVOIR EXPANSION ROUTT COUNTY, COLORADO

Lead Agency:	USDA - Forest Service Routt National Forest, Steamboat Springs, Colorado
Reviewing Agencies:	U.S. Fish & Wildlife Service U.S. Army Corps of Engineers U.S. Environmental Protection Agency Water Quality Control Division, State of Colorado Colorado Department of Natural Resources Colorado State Historic Preservation Office Colorado Division of Wildlife Routt County
Responsible Official:	Jerry E. Schmidt, Forest Supervisor Routt National Forest
Further Information:	Wendy Schmitzer Routt National Forest 29587 West U.S. 40, #20 Steamboat Springs, CO 80487 (303) 879-1722
	Sherry Reed, District Ranger Hahns Peak District 57 10th Street, Box 771212 Steamboat Springs, CO 80477 (303) 879-1870

ABSTRACT: The City of Steamboat Springs, in partnership with the Mt. Werner Water and Sanitation District, is proposing to enlarge the existing Fish Creek Reservoir, located on the Routt National Forest in Steamboat Springs, Colorado. Fish Creek Reservoir is a municipal water supply and is operated by the City under a Forest Service Special Use Permit: The Proposed Action, Alternative B, includes enlargement of the reservoir's water storage capacity from 1,842 acre-feet (AF) to 4,122 AF by raising the level of the main dam approximately 20 feet and reconstructing the saddle dam and spillway. Also proposed are the installation of an early warning system on both dams, and an underground powerline as the principal power source for the early warning system and remote off-site operations control. Two other alternatives were analyzed in detail, No Action (Alternative A), and a smaller reservoir expansion (Alternative C). In addition, two other alternatives that would be available to the City and Mt. Werner are displayed: Water Conservation, and Infiltration Gallery Expansion. At this time, considering the environmental impacts to public lands and the opportunities for use of those lands which would benefit the most people over the longest term, the Forest Supervisor prefers Alternative B. Following review of public comments on this Draft EIS, the Forest Supervisor will make a final determination as to which alternative best serves the public interest on National Forest System Lands. The U.S. Army Corps of Engineers may also make a decision concerning the issuance of a permit as is required under Section 404 of the *Clean Water Act, 1977.*

Reviewers should provide the Forest Service with their comments during the review period of this Draft EIS. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the Final EIS, thus avoiding undue delay in the decision-making process. Reviewers have the obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewer's position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978)). Environmental objections that could have been raised at the draft stage may be raised, if not waived, until after completion of the Final EIS (City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)). Comments on the Draft EIS should be specific and address the adequacy of the environmental impact statement and the merits of the alternatives discussed (40 CFR 1503.3).

Comments must be received by: April 12, 1993

Comments should be sent to: Jerry Schmidt, Forest Supervisor
Routt National Forest
29580 West U.S. Highway 40, Suite 20
Steamboat Springs, CO 80487

SUMMARY

SUMMARY

BACKGROUND

In February 1992, the City of Steamboat Springs (City), in partnership with the Mt. Werner Water and Sanitation District (Mt. Werner), submitted a Special Use Application to the Hahns Peak District of the Routt National Forest, Steamboat Springs, Colorado. The application requested authorization to expand the existing Fish Creek Reservoir, which is the primary municipal water supply for the City. The City is presently the special use permittee for the use, operation, and maintenance of the Fish Creek Reservoir.

The purpose of and need for the Proposed Action is as follows:

- Provide water storage to Mt. Werner and provide for long-term water demand
- Improve dam safety/public safety
- Provide for remote, off-site operation of the dam and water system
- Prevent continued environmental degradation to Puppy Dog Lake drainage
- Provide flow to maintain in-stream flow rights and enhance in-stream flows
- Provide a high quality water source to the service area
- Preserve recreation resources and fisheries

The *Routt National Forest Land and Resource Management Plan, 1983* (Forest Plan) identifies the Fish Creek Reservoir, and the area surrounding the reservoir, as a 10E management prescription area. The "10E" land management prescription provides for the management of municipal and supply watersheds. The purpose of and need for the Proposed Action is consistent with the Forest Plan, as are the alternatives identified and described in subsequent sections.

THE AFFECTED ENVIRONMENT

Fish Creek Reservoir is located on the Routt National Forest, four miles south of Buffalo Pass, in Routt County, Colorado. Fish Creek and Fish Creek Reservoir serve as the primary municipal water supplies for both the City and Mt. Werner. The reservoir presently covers approximately 90 surface acres and has a water storage capacity of approximately 1,842 acre-feet (AF). The reservoir has two earthen dams, the main dam and a saddle dam. Both dams are classified by the State as "Class A, High Hazard", since dam failure could cause extensive property damage, and possibly, the loss of life. During spring runoff and high flow periods a spillway routes water through a small lake, called Puppy Dog Lake, located below the saddle dam. The reservoir is operated manually, on-site by City personnel. Operation of the dam is limited seasonally, due to difficult accessibility caused by heavy snowfall.

The Upper Middle Fork of Fish Creek and Granite Creek provide water to the Fish Creek Reservoir. Access to the reservoir is seasonally limited and generally takes place during July through October of each year. Recreation activities at the reservoir, and within the immediate area, include fishing, hiking, picnicking, camping, biking, and viewing scenery. The reservoir and surrounding landscape are characterized by rocky outcrops, and the area vegetation includes large stands of mixed conifer forest, interspersed with open, upland meadows and montane wetland areas. In addition to the expanse of water provided by the reservoir, many smaller bodies of water are in the area such as wetlands, creeks, ponds, and lakes, including Summit Lake, Dinosaur Lake, and Long Lake.

A small Forest Service campground, Granite Campground, is located on the perimeter of the reservoir, and is a non-fee, walk-in campground with four campsites. Generally, use of this campground is limited to day use, although some overnight camping occurs. The existing facilities consist of several fire pits, a few tables, and a vault toilet that presently is not operational. A small boat ramp and parking lot are also present. Only non-motorized boats are allowed on the reservoir. Granite Campground experiences approximately 1,000 recreation visitor days per year.

SCOPING ISSUES

Public and interagency scoping for issues were accomplished early in the analysis process through public meetings, scoping documents, interagency meetings, and internal Interdisciplinary Team (ID Team) meetings. Other issues that emerged during the analysis process were also considered in formulating the scope of work and the alternatives. The issues that were considered to be significant and are addressed in detail include:

- Dam Safety/Flood Hazard
- Water Storage Requirements
- Hydrology/Fisheries
- Socioeconomics
- Wetlands

Other issues that were not considered as "significant", but were identified as providing important information to the analysis are:

- Vegetation
- Wildlife
- Water Rights
- Water Quality
- Recreation
- Transportation
- Visual Resources
- Cultural Resources

ALTERNATIVES

The Forest Supervisor's decision on this analysis falls under the alternatives available to the Forest Service. These alternatives include:

- Alternative A - No Action
- Alternative B - Fish Creek Reservoir Expansion (Proposed Action)
- Alternative C - Smaller Reservoir Expansion

Several options, which could be applied to the action alternatives (Alternatives B and C), are also presented. These options include:

- Campground Relocation Site Options
- Service Road Options
- Borrow Area Options

Two water supply alternatives fall outside of the Forest Service authority or ability to implement. These alternatives, however, are available to the City and Mt. Werner and include:

- Water Conservation
- Infiltration Gallery Expansion

These alternatives are discussed in the EIS and impacts associated with their implementation are addressed.

A description of the alternatives available to the Forest Service follows:

ALTERNATIVE A - NO ACTION

The National Environmental Policy Act (NEPA) requires that a No Action Alternative be considered in all environmental documents. This alternative serves as the baseline for estimating the impacts of the other alternatives presented in the EIS. For the purposes of this analysis, the No Action Alternative describes the current condition of the reservoir. Under this alternative, a new Special Use Permit would not be granted by the Forest Service to expand the existing Fish Creek Reservoir and the City would continue to operate the reservoir under its existing Special Use Permit.

Environmental Consequences of Alternative A

Under Alternative A, Granite Campground and the existing service roads would not be upgraded and would continue to deteriorate. The reservoir would continue to operate without an early warning system to alert downstream residents of a potential flood hazard. There would be no power source for the development of an off-site, remote operational control system for the reservoir. The reservoir system would continue to be operated manually, on-site. The environmental degradation to the Puppy Dog Lake drainage would continue to occur. No conservation pool would be available to maintain fisheries during reservoir drawdown. Available in-stream flows would not provide for Colorado Water Conservation Board's junior in-stream flow rights in lower Fish Creek. Consequently, the lower reaches of Fish Creek would continue to be reduced to very low flow or no flow conditions. The City would have sufficient water storage capacity to meet present and future (2010) water demands. Mt. Werner, however, would have to develop storage capacity, or alternative water supplies, to meet present and future demands. There would be no impact to wetlands. No funds would be spent for the proposed reservoir expansion. Mt. Werner, however, has secured a loan for the proposed project and is presently making penalty interest payments of $80,000 per year until exercised or returned.

ALTERNATIVE B - FISH CREEK RESERVOIR EXPANSION (PROPOSED ACTION)

Under Alternative B, the Proposed Action, the Forest Service would issue a new Special Use Permit to the City to enlarge, use, operate and maintain Fish Creek Reservoir. The proposal includes raising the height of the existing main dam by 20 feet, reconstructing and raising the saddle dam, and creating a new spillway channel. The expansion would allow for an additional 2,280 AF of water storage, from 1,842 AF to approximately 4,122 AF. Fifty acres of shoreline would be inundated, changing the present size of the reservoir from 90 acres to 140 acres. An early warning system would be installed in both the main and saddle dams. An electric underground powerline would be installed to provide power to the early warning and remote off-site operational control system. Funding for this proposal would be provided by both the City and Mt. Werner, with the City financing 25 percent and Mt. Werner financing 75 percent of the cost (see Appendix I, *City Council*

Resolution/Reservoir Financial Plan). City Council has passed a resolution approving the participation of the City in the financing of this proposal, providing that the Proposed Action is approved and all necessary permits are granted. The estimated cost of the Proposed Action is $6,000,000 which equates to a unit cost (cost per AF of water) of approximately $2,600/AF. Mt. Werner has secured a loan for the proposed project, and is presently making penalty interest payments of $80,000 per year until exercised or returned.

Environmental Consequences of Alternative B

Under this alternative, 15.09 acres of wetlands would be affected. Construction activities would temporarily worsen the condition of the Buffalo Pass Road and access road to the reservoir. Construction activities would also temporarily disrupt recreationists in the immediate area. Granite Campground would be unavailable until relocated and rebuilt. The reservoir would be drained and no fishery would be sustained during the proposed two-year construction period. The operation of the reservoir would be improved by the use of an off-site, remote operational control system. Public safety concerns would be addressed by the installation of an early warning system in both dams. Mt. Werner's need for immediate and long-term water storage capacity would be met. Long-term water demands by the City would continue to be met. Degradation to Puppy Dog Lake drainage would be stopped and corrective actions would be taken. Service roads would be upgraded. Granite Campground would be relocated and re-created with new facilities. Accessibility for the handicapped would be provided as required by the American Disabilities Act. Cultural resources would not be affected. A conservation pool for fisheries would be available after construction and the reservoir would be restocked. In-stream flow would be maintained in lower Fish Creek and, therefore, Fish Creek would remain a live, year-round stream to the confluence with the Yampa River. Visual resources would be affected by the enlargement of both dams. Debt obligation would occur for both the City and Mt. Werner for the proposed $6,000,000 expansion.

ALTERNATIVE C - SMALLER RESERVOIR EXPANSION

Under Alternative C, the Forest Service would issue a new Special Use Permit to the City to enlarge, use, maintain and operate the Fish Creek Reservoir. The expansion would provide for an additional 908 AF of water storage capacity. The size of the reservoir would be increased to 112 surface acres, a change of about 22 acres from its present size. The main dam would be raised eight (8) feet and the saddle dam would be raised 10 feet. A spillway channel would be constructed, adjacent to the saddle dam. An early warning and remote operational control system would be installed. The City and Mt. Werner would share in the financing of this smaller reservoir expansion. The estimated cost of Alternative C is $4,200,000 which equates to a unit cost (cost per AF of water) of approximately $4,600/AF.

Environmental Consequences of Alternative C

The environmental consequences of Alternative C are the same as Alternative B with the following exceptions:

- 8.80 acres of wetlands would be impacted
- Mt. Werner would have to develop additional water supplies to meet projected demands

- The additional water supply would not likely be of the same water quality as the water from Fish Creek

- The total financial obligations for reservoir expansion ($4,200,000) would be less than under Alternative B

- The cost of construction per AF of water would be $4,600 as compared to $2,600 under Alternative B

- Potential impacts to the socioeconomic climate of the community could result if the lack of water resources restricts growth

- A long-term conservation pool for fisheries would not be possible

- Future in-stream flow augmentation would be reduced, or not possible, during certain times of the year

MITIGATION

Mitigation necessary to ensure protection of the environment is briefly summarized below. The nature and extent of mitigation is dependent upon the alternative selected by the Forest Supervisor. A complete mitigation plan will be prepared by the Forest Service prior to release of the Final EIS.

Under the No Action Alternative, the Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operation plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

<u>Wetlands</u> - The U.S. Army Corps of Engineers (COE) would require a 404(c) permit for the dredge and fill activities associated with either Alternative B or C. Under both alternatives, existing wetlands would be lost and replaced. A wetlands mitigation plan has been developed for submittal to the COE. A replacement ratio of 1.5 acres for every 1.0 acre of wetlands lost is being suggested. The immediate short-term goal for mitigation would be to artificially construct wetlands of similar size and configuration to those that would be directly or indirectly impacted under Alternative B or C. The long-term goal would be to ensure that the artificially constructed wetlands provide equivalent functions and values as those impacted as a result of either action alternative.

<u>Puppy Dog Lake Drainage</u> - The Forest Service has identified a need for change in the current operation of the reservoir system to control the significant erosion and channel degradation taking place in the Puppy Dog Lake drainage. The proposed expansion would increase the water storage capacity available to contain spring runoff flows, increase the outlet capacity of the main dam into the Middle Fork of Fish Creek, and allow for remote operation of the outlet structure. These design features would allow operation of the reservoir to be altered such that a greater portion of spring runoff flows could be stored, and/or released, through the main outlet structure in order to reduce flow volumes released through the spillway. Restoration of degraded areas would occur both naturally and through manual restoration efforts. Monitoring of channel flows would occur.

Water Depletion - Depletion of water from the reservoir and stream system would be mitigated in the form of a payment by the proponents to the U.S. Fish and Wildlife Service, per their depletion formula (See Appendix J, *Biological Assessment*).

Water Rights - Under Alternative B, 200 AF of storage capacity would be released to augment in-stream flows in Fish Creek below the intake to the water filtration plant. A stipulation has been reached between the City and the Colorado Water Conservation Board (CWCB) to meet this CWCB junior in-stream flow right.

Construction-Related Activities - If an action alternative is chosen, all plans concerning the construction of new facilities at Fish Creek Reservoir would be approved by the Forest Service, prior to implementation. Construction plans would include detailed descriptions of transportation plans, water quality monitoring plans, on-site worker facilities, schedules, safety plans, explosive plans, timing of activities, monitoring by proponents, and best management practices.

Recreation - Temporary interruption of recreational activities would occur under Alternatives B or C. Recreationists would be dispersed and directed to other camping and fishing facilities in the area. Informational signs and media notification would be implemented.

Fisheries - Fishing opportunities would not exist during construction under Alternatives B or C. The reservoir would be restocked after completion of construction activities. The Colorado Division of Wildlife is considering what type of fish to restock. A regular stocking schedule would be negotiated between the City and the Colorado Division of Wildlife. A conservation pool would be established and is presently being analyzed by the Colorado Division of Wildlife.

Visual Resources - Design criteria would incorporate Forest Service Visual Quality Objectives to maintain the integrity of the aesthetic environment.

Campground Restoration and Relocation: Loss of the existing Granite Campground under Alternatives B or C would be mitigated by reconstruction and relocation of the campground. A new state-of-the-art campground would be constructed and include accessibility for the handicapped, as required under the American Disabilities Act. The timing of the construction of the proposed new campground would coincide with construction activities of the reservoir. The campground would be fully operational at the completion of the reservoir enlargement under Alternatives B or C. Construction plans would be approved by the Forest Service prior to commencement of construction. The Forest Service and the project Proponent would inspect construction activities.

Service Roads: The service roads to the dams are presently deteriorating and a portion of the service road to the main dam would be inundated under Alternatives B and C. The roads would be upgraded to present Forest Service standards, including proper drainage and maintenance. That portion of the road to be inundated would be relocated, minimizing visual and wetlands impacts.

PREFERRED ALTERNATIVE

The Forest Service preferred alternative is Alternative B.

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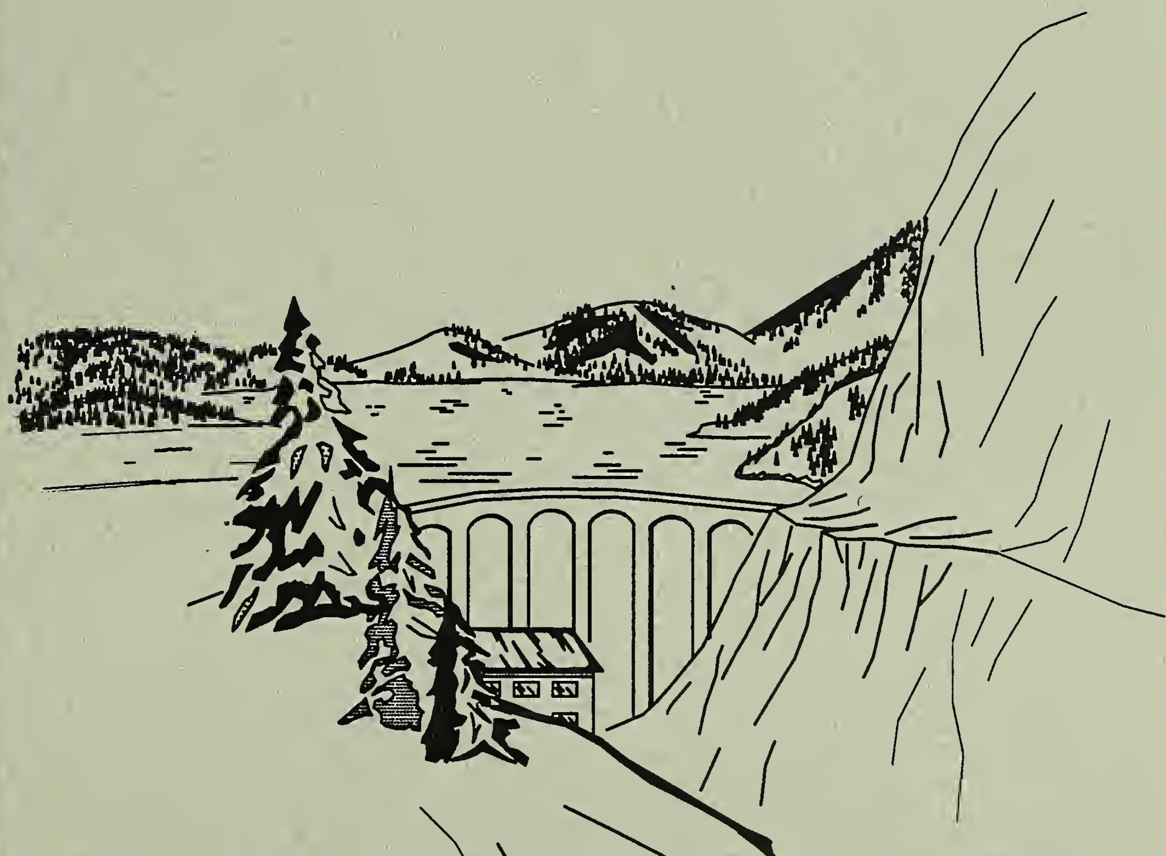

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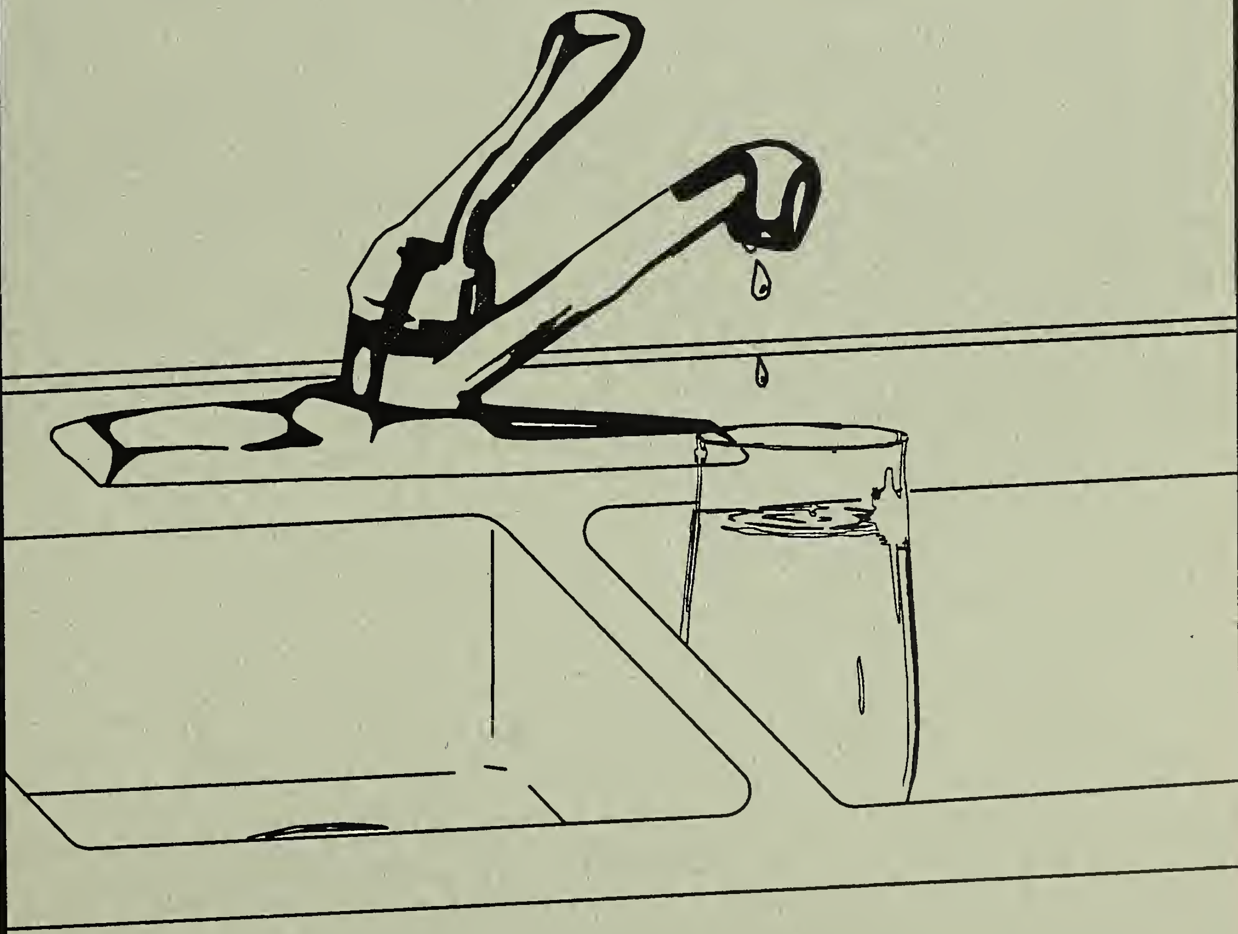
CHAPTER 1

PURPOSE OF & NEED FOR ACTION



CHAPTER 1 - PURPOSE OF AND NEED FOR ACTION

1.1 BACKGROUND

The City of Steamboat Springs (City), in partnership with the Mt. Werner Water and Sanitation District (Mt. Werner), is proposing to enlarge Fish Creek Reservoir by raising the height of the existing main dam 20 feet, reconstructing and raising the saddle dam, and creating a new spillway channel. The proposal provides for an increase in storage capacity of 2,280 acre-feet (AF) from 1,842 AF to 4,122 AF. Fifty acres of shoreline would be inundated, changing the present size of the reservoir from 90 acres to 140 acres. Also included in the expansion proposal is the installation of an early warning monitoring system, and the development of a remote, off-site management system for the operation of the reservoir. An electrical underground powerline, stemming from an existing powerline on Buffalo Pass, is being proposed to provide power for the remote operation of the dam and the early warning monitoring system. The construction activities associated with the proposal would take two summer construction seasons to complete. The City and Mt. Werner are referred to collectively as the "Proponent".

Fish Creek and Fish Creek Reservoir are the primary municipal water supplies for both the City and Mt. Werner. Fish Creek Reservoir is located on the Routt National Forest, four miles south of Buffalo Pass, in Routt County, Colorado, as shown in Figure 1-1, General Location. The City is the holder of a Special Use Permit for the use and operation of the reservoir, which is administered by the United States Department of Agriculture (USDA) - Forest Service (Forest Service). The management prescription for the area surrounding the reservoir, as identified in the *Routt National Forest Land and Resource Management Plan, 1983* (Forest Plan), is 10E, which provides for management of municipal and supply watersheds. A general description and goals of the 10E management prescription are as follows:

> *"Management emphasis is to protect or improve the quality and quantity of municipal water supplies. Management practices may vary from use restrictions to water resource improvement practices, with the primary object of meeting water quality standards established from the individual watershed. A secondary objective is to manage the watershed to improve the yield and timing of water flows, consistent with water quality requirements"* (USDA Forest Service, 1983).

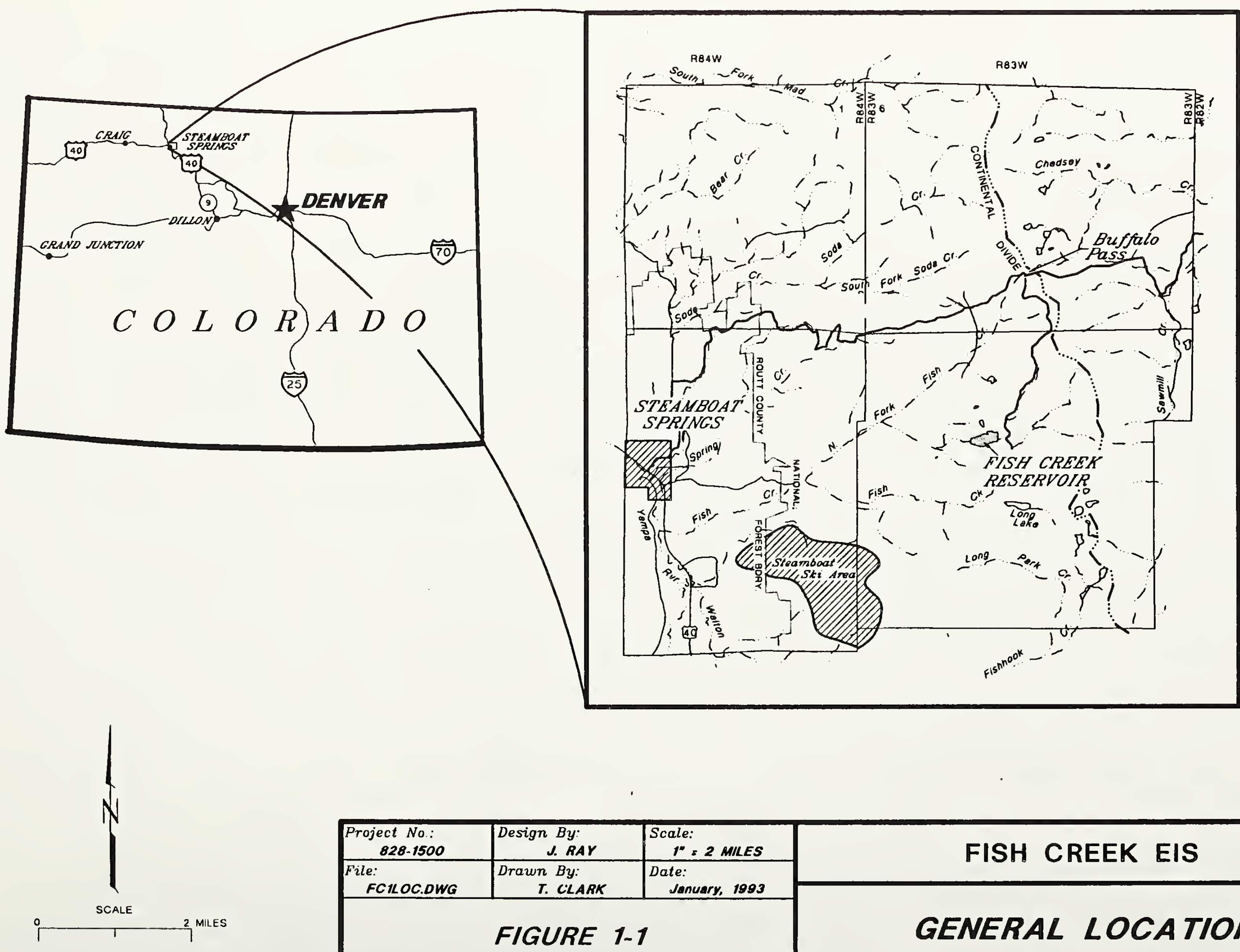
The management prescriptions for Fish Creek Reservoir and the surrounding area are shown in Figure 1-2, Management Prescriptions.

1.2 PURPOSE OF AND NEED FOR PROPOSED ACTION

The purpose of and need for the proposed action, as described below, is consistent with the Forest Plan. The purpose and need is best described by the following project goals and objectives:

1.2.1 Provide Water Storage to Mt. Werner Water and Sanitation District and Provide for Long-Term Water Demand

The City and Mt. Werner are two separate water providers. The City relies upon natural Fish Creek streamflow and water stored in Fish Creek Reservoir and Long Lake to meet its water demands. Mt. Werner, on the other hand, has no water storage capacity, and relies primarily



Project No.: 828-1500	Design By: J. RAY	Scale: 1" = 2 MILES	FISH CREEK EIS
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FIGURE 1-1

GENERAL LOCATION

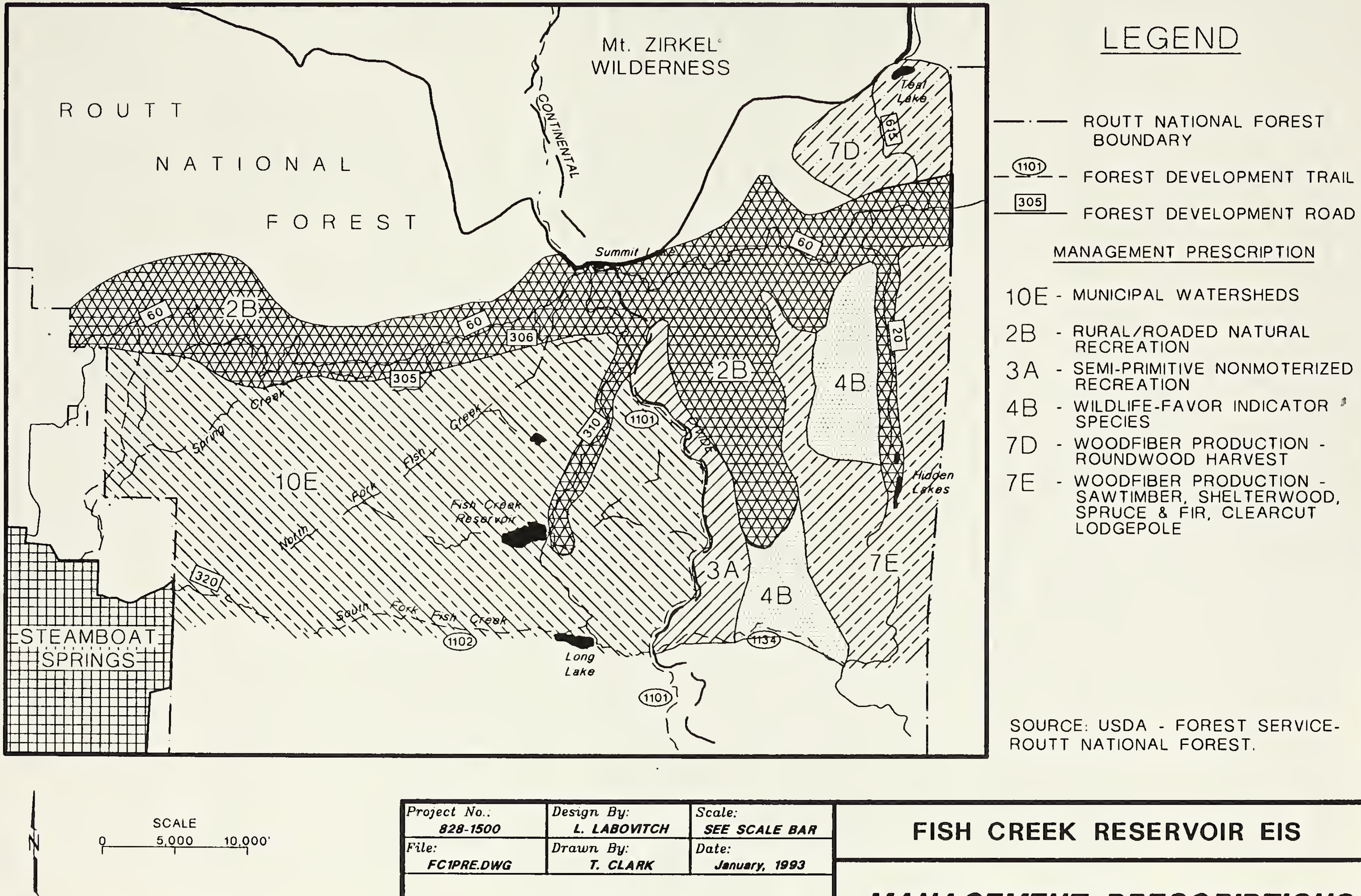

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FIGURE 1-2

FISH CREEK RESERVOIR EIS

MANAGEMENT PRESCRIPTIONS

upon Fish Creek flow to meet its water demands. The City owns and operates the reservoir. The City and Mt. Werner share in the ownership of the Fish Creek Water Filtration Plant, which is operated by Mt. Werner.

The City has a conditional water storage right of 2,200 AF, which it proposes to exercise through the enlargement of the Fish Creek Reservoir. While the City has the storage capacity to accommodate present water demands, Mt. Werner has an immediate need for water storage. Mt. Werner presently "borrows" storage water from the City's reservoir supply in order to meet its demands during periods of low flow in Fish Creek (ACZ, 1992b). Additional water storage capacity is also necessary to meet projected future demands.

1.2.2 Improve Dam Safety/Public Safety

Fish Creek Reservoir is located in a remote location on the Routt National Forest. Due to the amount of snowfall in the area, access to the reservoir is limited from November through June of each year. The reservoir and dams are usually covered by snow eight months of the year. Because of the remote location of the reservoir and heavy snow coverage, it is impossible to detect seeps or leakage at the dams during most of the year. In addition, the ability to reach the dams, in the event of an indication of dam failure, is severely limited by these factors.

Fish Creek Reservoir has two earthen dams, the main dam and the saddle dam. Both dams are classified as "Class A - High Hazard," since dam failure could cause extensive downstream property damage, and possibly, the loss of life. These dams presently do not have an early warning system installed to alert the City of potential dam problems. The enlargement proposal includes the installation of an early warning monitoring system that would alert the City to any sudden increase or decrease in the water flow below the dams and/or any change in pressure within the dams. This system would allow the City to investigate, and respond to, any unusual changes in water pressure (head) and/or flow and continually maintain the integrity of the dams. Additionally, it would enhance the City's ability to warn residents and implement an emergency evacuation plan in the event of an imminent dam failure.

1.2.3 Provide for Remote, Off-Site Operation of the Dam and Water System

The operation and control of water releases from the Fish Creek Reservoir presently occur on-site. Releases from the reservoir are made by manual adjustments to the outlet gate in the spring and fall of each year. Under best conditions, this requires a half day to accomplish. Under adverse conditions, it is not possible at all. Consequently, reservoir releases are generally made in excess of demand. The enlargement proposal provides for the ability to operate releases from a remote, off-site location. Remote operation would allow for the controlled release of water in response to water demands and for the maintenance of in-stream flow. It would also provide for immediate operator attention to any changes in dam characteristics. An underground electric powerline is being proposed as the power source for both the remote dam operation system and early warning alarm system.

1.2.4 Prevent Continued Environmental Degradation to Puppy Dog Lake Drainage

The Forest Service has identified a need for change in the current operation of the reservoir system to control the significant erosion and channel degradation taking place in the Puppy Dog Lake drainage. Puppy Dog Lake is a small lake just below the Fish Creek Reservoir saddle dam and spillway. As the reservoir presently operates, high spring runoff flows are released through the

spillway to Puppy Dog Lake and its drainage channel, rather than through the main channel of the Middle Fork of Fish Creek. The drainage area of the Puppy Dog Lake drainage is approximately 16 percent of the drainage area of the Middle Fork of Fish Creek at the main dam. Due to the large flow volumes routed through the Puppy Dog Lake drainage during the spring runoff period, the drainage basin has been significantly altered. Severe erosion of the existing channel has resulted and has caused downstream sedimentation.

The proposed expansion would increase the water storage capacity available to contain spring runoff flows, increase the outlet capacity of the main dam into the Middle Fork of Fish Creek, and allow for remote operation of the outlet structure. These design features would allow operation of the reservoir to be altered such that a greater portion of spring runoff flows could be stored, and/or released through the main outlet structure in order to reduce flow volumes released through the spillway. Restoration of degraded areas would occur both naturally and through mitigation efforts.

1.2.5 Provide Flow to Maintain In-Stream Flow Rights and Enhance In-Stream Flows

The Colorado Water Conservation Board (CWCB) holds a junior in-stream flow right of 2 cubic feet per second (cfs) on Fish Creek, downstream of the water filtration plant. However, with diversions from the stream to the filtration plant, and to several ditches below the filtration plant, flow in Fish Creek commonly drops below 2 cfs. This occurs primarily in August and September when stream flow is at a minimum but water demand, both municipal and agricultural, is still high. Although the CWCB rights are junior water rights within the Fish Creek basin, under the Proposed Action CWCB and the City have a stipulated agreement ensuring that the 2 cfs in-stream flow right would be maintained. The additional storage capacity and the remote operational control provided by the proposed action would allow for maintenance of the CWCB in-stream flow right. The stream below the filtration plant to the Yampa River would remain a live stream throughout the entire year, and the potential to maintain fisheries in this reach of the stream would be enhanced. Additionally, increased flow to the Yampa River would contribute to downstream fish habitat.

1.2.6 Provide High Quality Water Source to Service Area

The expansion of the Fish Creek Reservoir would ensure that the high quality water supply presently available to the City and Mt. Werner would continue to be available to meet future water demands. Expansion of this water source would preclude the need to utilize the infiltration galleries (well fields) as a primary water supply. While the City and Mt. Werner occasionally utilize the well fields as a back-up water supply, water quality concerns and costs associated with infrastructure, treatment, and pumping, discourage their expansion.

1.2.7 Preserve Recreational Resources and Fisheries

Projected water demands for the City and Mt. Werner indicate that the present reservoir would be virtually drained on an annual basis to meet future water needs (ACZ, 1992b). In order to protect the existing recreational resources and maintain a viable lake fishery, a conservation pool is being recommended by the Forest Service. (A conservation pool is the volume of water required to allow regular over-wintering of healthy, self-sustaining fish populations). The size of the conservation pool is being determined by the Colorado Division of Wildlife and will be displayed in the Final EIS. The amount of water storage capacity needed to maintain this conservation pool will directly affect the total reservoir capacity and will be factored into the Final EIS.

1.3 RESPONSIBLE OFFICIAL AND DECISION TO BE MADE

An Environmental Impact Statement (EIS) is a document that discloses the environmental consequences of implementing a proposed action and alternatives to that action. It is not a decision document itself, but rather the analysis upon which the decision can be reached. The decision is documented in a Record of Decision (ROD) and is made by the Routt National Forest Supervisor. The Forest Supervisor may select one of the alternatives analyzed in this EIS in total, or a portion, combination, or modification of the alternatives analyzed. Management constraints and/or mitigation measures may also be specified. The Forest Supervisor's decision applies only to National Forest lands analyzed in the EIS.

The Forest Supervisor's decision on this analysis falls under the alternatives available to the Forest Service. These alternatives are as follows:

- To deny the permit (Alternative A - No Action)
- To approve the proposal (Alternative B - Fish Creek Reservoir Expansion (Proposed Action))
- To approve the proposal as modified (Alternative C - Smaller Reservoir Expansion)

Because some significant issues raised fall outside of the Forest Service authority or ability to implement, the impacts associated with those issues are nevertheless being disclosed under alternatives available to the City and Mt. Werner, in keeping with the National Environmental Policy Act's (NEPA) disclosure requirement. Additional alternatives available to the Proponent, but outside the jurisdiction of the Forest Service include:

- Water Conservation
- Infiltration Gallery Expansion

1.4 AGENCY RESPONSIBILITY

Consistent with the stated purpose and need and related requirements for regulatory approvals, this EIS will be used by a number of Federal, State, and local agencies and governmental entities, having jurisdictional responsibility for affected lands and resources. Information presented in this EIS will be the basis for evaluation of the project proposal and alternatives with respect to potential project-related environmental impacts, both beneficial and adverse, and for regulatory compliance. Decisions by other jurisdictions to issue or not issue approvals related to this proposal may be aided by the disclosure of impacts found in this document. However, other jurisdictions may require additional information relative to their permitting process requirements. The following sections identify those agencies and other government entities having jurisdictional responsibility for review of and/or action on the project proposal.

1.4.1 Federal Government

1.4.1.1 Forest Service

The Forest Service must issue a Special Use Permit prior to any development on National Forest land. Additionally, prior to any construction on National Forest land, construction plans must be submitted to, and approved by, the Forest Service. Operating plans must be submitted to, and approved by the Forest Service, for both construction activities and post-construction system operation. The Special Use Permit becomes operational after all permits and approvals, as required by law, are issued. Although the City already has a Special Use Permit for the present operation of the reservoir, a new permit would be required if the Special Use Application for the reservoir expansion is approved.

1.4.1.2 United States Army Corps of Engineers (COE)

The U.S. Army Corps of Engineers (COE) is responsible for compliance with *Section 404(c) of the Clean Water Act of 1977*, that addresses protection of the waters of the United States, including jurisdictional wetlands. Section 404 prohibits discharge of dredged or fill material into waters of the United States without a valid 404 Permit. "Waters of the United States" are broadly defined as any navigable waterways, including streams and harbors, and jurisdictional wetlands meeting the designation criteria presented in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (COE/EPA/FWS/SCS, 1987).

Potential impacts to jurisdictional wetland areas totalling more than one acre are reviewed and approved or denied under a site-specific 404 Permit application. A 404 Permit will be required if the Special Use Application is approved.

1.4.1.3 Environmental Protection Agency (EPA)

Under NEPA, the Environmental Protection Agency (EPA) is required to review and comment on "major federal actions that have a substantial impact on the human environment." The EPA's responsibility and role is to provide scoping comments, review EIS's, and provide information and appropriate technical assistance during and following the environmental analysis process. Specific environmental legislation, for which the EPA is responsible and that is applicable to the proposal, include the *Clean Water Act* and the *Safe Drinking Water Act*. Some administrative and enforcement responsibilities of these acts have been delegated to the State of Colorado.

1.4.1.4 United States Fish and Wildlife Service (USFWS)

Under the provisions of the *Fish and Wildlife Coordination Act*, the United States Fish and Wildlife Service (USFWS) provides consultation regarding federally permitted projects that affect fish and wildlife resources. Under Section 7 of the *Endangered Species Act*, the USFWS provides consultation on potential impacts to threatened and endangered species and issues a biological opinion. Formal Section 7 consultation will be initiated with the USFWS between the Draft and Final EIS.

1.4.2 State Government

1.4.2.1 Colorado Department of Health - Water Quality Control Division (WQCD)

The Water Quality Control Division (WQCD) has authority under CRS 25-8-302 to implement Section 401 of the Federal Clean Water Act. The WQCD reviews projects which require federal licenses and permits (such as a COE Section 404 permit), and certifies, conditionally certifies, or denies certification. Certification is given if no significant impairment of a classified use by exceedence of water quality standards can be reasonable assured. The WQCD may specify certain management and certification requirements as detailed in their regulations governing 401 certification.

Additionally, the WQCD requires that permits be obtained for wastewater treatment facility discharges, dewatering, and stormwater runoff.

The WQCD also approves the location, design, and capacity of water and/or wastewater treatment facilities.

1.4.2.2 Colorado Department of Natural Resources (CDNR)

Several divisions within the Colorado Department of Natural Resources (CDNR) have project responsibilities, including:

- Colorado Division of Wildlife (CDOW) - The CDOW is responsible for protection and management of state wildlife and fish resources through participation in NEPA and Section 404 of the Clean Water Act.

- Colorado Geological Survey (CGS) - The CGS is responsible for the identification of geologic hazards and may suggest mitigation measures to reduce potential geologic impacts.

- Colorado Water Conservation Board (CWCB) - The CWCB is responsible for providing floodplain information and analysis of water supply and flood hazard mitigation. The CWCB is also responsible for the maintenance of minimum in-stream flows.

- State Engineer/Colorado Division of Water Resources (CDWR) - The CDWR is responsible for administering water rights. They are also responsible for dam safety and for the review and approval of dam designs.

1.4.2.3 Colorado State Historic Preservation Office (SHPO)

The State Historic Preservation Office (SHPO) reviews and provides guidance to the Forest Service on cultural resource investigations, determinations, and mitigation plans. SHPO must concur with any recommendation of eligibility of a site or structure to the National Register of Historic Places. SHPO also consults with the Advisory Council on Historic Preservation in compliance with the *National Historic Preservation Act* (16 U.S.C. 470F).

1.4.3 Local Government

Routt County reviews NEPA documents for consistency with County planning actions. The County also provides review of transportation concerns, road impacts, infrastructure requirements, and identifies other County planning concerns.

1.5 SCOPING AND PUBLIC INVOLVEMENT

As required by NEPA (CEQ 1501.7), the Forest Service has provided for an early and open process to determine the scope and significance of issues to be analyzed, and to determine what type of environmental analysis should be prepared. Both internal (Forest Service) and external (public) scoping efforts led to the decision to prepare an Environmental Impact Statement to disclose the impacts of the proposed action on the physical and human environment.

The Forest Service began public scoping by mailing a scoping document to all boxholders in the City on March 6, 1992. This scoping document identified the project Proponent and provided information to the public relative to the proposal, location, possible issues, and alternatives to be discussed. A public meeting was held on March 18, 1992 to discuss the proposal, receive comments, and identify public issues. Approximately 30 public comment letters have been received to date, and are presented in Appendix A, Public Comment Letters. Newspaper articles have continued to provide information to the public. The Forest Service identified its Interdisciplinary Team (ID Team), comprised of specialists from those resources affected by the issues identified. An ID Team meeting was held on May 29, 1992 to scope for internal issues and additional concerns not identified by the public. Issues were determined to be significant or insignificant, and the scope of the EIS was established. Minutes from the ID Team meeting were taken and are displayed in Appendix B, ID Team Meeting Minutes. Members of the ID Team are listed in Chapter 5, List of Preparers.

Other scoping efforts included:

- A meeting with an EPA representative and the Forest Service in Steamboat Springs on August 4, 1992 to discuss the project and EPA issues and concerns.

- A meeting with Division of Wildlife (DOW) representatives on August 4, 1992 to discuss fisheries and wildlife issues and any other DOW concerns relative to the proposed project.

- An interagency meeting, hosted by the Corps of Engineers (COE), in Grand Junction, Colorado on September 16, 1992 which included the USFWS, the Division of Wildlife (DOW), and the EPA. The Forest Service presented the project proposal and discussed progress on the EIS. The City also participated at the meeting by providing background technical information to the agencies. During the meeting, the agencies raised issues and provided comments to the Forest Service for consideration in the EIS analysis.

- The Forest Service met with the Routt County Commissioners on October 19, 1992, to discuss the project and the analysis. The Commissioners provided comments and identified County issues for consideration in the EIS.

The Forest Service will continue to take public and agency comment following the publication of the Draft EIS.

1.6 ISSUES AND CONCERNS

As a result of the public and agency scoping efforts and ID Team comments, many issues were identified for analysis in the EIS. As required by NEPA, the significance of the issues was then determined. "Significant" issues require in-depth analysis and "insignificant" issues require reasonable justification for not analyzing in detail. To determine the significance of each issue, the ID Team referred to NEPA's definition of "significantly" (40 CFR 1508.27). This definition states that the issue must be considered for context and intensity. The significance of an action varies with the severity of the impacts associated with the proposed action (whether they be beneficial or adverse), and with the setting of the proposed action. *"This means that the significance of an action must be analyzed in several contexts such as the society as a whole (human, national), the affected region, the affected interests, and the locality".*

The ID Team decisions regarding the significance of issues were recorded and are displayed in the ID Team Meeting Minutes presented in Appendix B. These decisions are not final, as NEPA requires agencies to revise determinations if *"substantial changes are made later in the proposed action, or if significant new circumstances or information arise which bear on the proposal or its impacts"* (40 CFR 1501.7).

Following is a synopsis of the issues, concerns, and questions identified by the public and members of the Forest Service ID Team.

1.6.1 Significant Issues

1.6.1.1 Dam Safety/Flood Hazard

A number of comments were received during the scoping process pertaining to dam safety and flood hazard. The primary issues and concerns associated with dam safety and flood hazard include the following:

- **Impacts of a dam failure and a potential flood to the City of Steamboat Springs and residents, workers, and visitors downstream of the dam.** Several individuals expressed concern over the issue of a potential dam failure. Under this issue, the potential for, and consequences of a dam failure, are analyzed in the EIS for the existing structure and all dam alternatives. Engineering studies and flood models for the reservoir are reviewed. The potential for ground shaking and ground rupture is determined based on public information available on faulting and seismic conditions. The City's Emergency Response Plan is reviewed.

- **Impacts of an early warning system.** The proposed early warning system is evaluated in the EIS and the potential impacts of the system are discussed.

Dam safety and flood hazard issues and concerns are addressed in sections 3.2 and 4.2 of this document.

1.6.1.2 Water Storage Requirements

Many questions and concerns have been raised by the public regarding the need for an expansion of Fish Creek Reservoir. The primary issues and concerns expressed about the water storage requirements for the project include the following:

- **The timing and size of the proposed reservoir expansion.** Several members of the community expressed concern over the timing and the size of the proposed project. Water usage patterns for the City and Mt. Werner are reviewed to determine whether the need exists for additional water storage. The timing of the proposed expansion is also evaluated. Storage volume requirements are determined for the City, Mt. Werner, and the two water districts combined.

- **Location and distribution of water need.** A concern of the community is the location and distribution of the water need. This EIS analysis assesses water storage requirements for the City, Mt. Werner, and the two water districts combined. It further analyzes whether additional water is necessary for future growth within the existing water service area or whether it is required for an expanded water service area. Water requirements associated with tourism are factored into the analysis.

- **Potential impacts of water conservation programs on the need for additional water storage.** The need for a more comprehensive water conservation program for the community was expressed by several individuals. To evaluate conservation strategies and potential water savings, water conservation methods are reviewed in this EIS document, and the results of a survey of other tourist communities in the southwest are presented. The potential impacts of water conservation on water demand and water storage requirements are assessed. The impacts of conservation are disclosed, although the Forest Supervisor does not have the authority to select conservation as an alternative available to the Forest Service.

- **Potential impacts of consolidation of water districts on the need for additional water storage.** Several community members questioned whether consolidation of the City and Mt. Werner water districts would impact the potential need for expansion of the Fish Creek Reservoir. The impacts of a consolidated district are disclosed, although the Forest Supervisor does not have the authority to select consolidation as an alternative available to the Forest Service.

Water storage requirements are discussed in Section 3.3.7 and 4.3 of this document. Conservation is evaluated in Section 2.7, and Appendix C.

1.6.1.3 Hydrology/Fisheries

Many questions and concerns raised by the public during the scoping process pertained to the maintenance of in-stream flows in Fish Creek and the subsequent impacts to fisheries. The primary issues and concerns expressed about fisheries include the following:

- **Potential impacts of changes in channel flow regimes on present fisheries.** While several individuals expressed the need for fish habitat improvement through maintenance of in-stream flows, others felt that flow modifications were unnecessary. The flow regime within Fish Creek is reviewed in the EIS and the

impacts of water system operations are assessed. The potential impacts of in-stream flow maintenance to fisheries are discussed.

- **Loss of fisheries during construction activities.** The impacts related to the loss of fisheries during construction activities are addressed in this EIS document; restocking of Fish Creek Reservoir is discussed.

Fisheries are discussed in Section 3.8, Section 4.8 and Appendix J of this document. A discussion of hydrology is presented in Section 3.3.2 and Section 4.3.

1.6.1.4 Socioeconomics - Project Cost

A number of comments were received, during the scoping process, pertaining to the cost of the proposed project and the subsequent impacts to residents of the community, especially those on fixed incomes. The primary issues and concerns associated with project cost include the following:

- **The cost of the proposed project.** Several questions were raised during public scoping concerning the cost of the proposed project and the impacts of funding the project to local residents. The costs associated with the proposed reservoir enlargement and alternatives are reviewed and disclosed in the EIS.

- **The financing mechanism of the proposed enlargement.** Associated with the project cost, and receiving significant comment during the scoping process, is the financing mechanism proposed to fund the project. Concern was expressed that project implementation might result in additional taxes and/or user fees which would impact local residents, especially those on fixed incomes. Several individuals suggested that local citizens should not bear the burden of water supply costs if additional storage capacity is not needed for their immediate welfare. The philosophy that development should pay for itself (ie. - the water supply needs of future development should be paid for by that development) was expressed. The financing mechanism and the impacts to the community are examined and presented in the EIS.

- **The equity of the financing plan.** The issue of project equity was raised during the scoping process (ie. - who is paying for and who is benefitting from the project?). The project costs, financing plan, and benefits are presented and project equity is discussed.

Socioeconomic issues and concerns are evaluated in sections 3.4 and 4.4 of this EIS.

1.6.1.5 Socioeconomics - Consequential Growth Impacts

Concern was expressed during the public comment period that expansion of the Fish Creek Reservoir would result in additional growth in the Yampa Valley. The opposing concern, that restricting the water supply would limit growth opportunities, was also presented. The primary issues and concerns associated with consequential growth impacts include:

- **Impacts of water availability on community growth.** The relationship between water supply and community growth and development are evaluated in this EIS

document. The question of water storage limiting, promoting, or enabling growth is also addressed.

- **Relationship between water supply and quality of life issues.** Several questions raised during the scoping process pertained to the relationship between water availability and the quality of life within the community. Will additional water storage result in community growth and subsequent changes in lifestyle and quality of life in the community? Will limiting water storage restrict growth within the community and result in a lack of low income housing and an increased cost of living? The relationship between water storage, community growth, and the quality of life within the community is also evaluated.

Socioeconomic issues and concerns are discussed in sections 3.4 and 4.4 of this document.

1.6.1.6 Wetlands

The impacts of the proposed project to wetlands and wildlife habitat are of concern to the public. The primary issues and concerns associated with wetlands include the following:

- **Impacts to existing wetlands in the proposed project area.** The effect of the proposed project and project alternatives on wetlands are evaluated and permitting issues are discussed. The relationship between wetlands and proposed borrow sources are assessed.

- **Potential opportunity to enhance wetlands and wildlife habitat.** The wetlands mitigation plan is reviewed and summarized in the EIS.

Wetlands issues are addressed in Sections 3.5 and 4.5 of this EIS.

1.6.2 Other Issues

1.6.2.1 Vegetation

The potential impacts of the proposed project and project alternatives to vegetation and threatened and endangered species are evaluated (see Sections 3.7 and 4.7).

1.6.2.2 Wildlife

Concern was expressed during scoping for the protection of wildlife habitat. The potential impacts of the proposed project and project alternatives to wildlife, wildlife habitat, and threatened and endangered species are presented (see Sections 3.8 and 4.8).

1.6.2.3 Water Rights

Potential impacts of the proposed reservoir expansion and project alternatives to existing water rights are addressed (see Sections 3.3.3 and 4.3).

1.6.2.4 Water Quality

Potential impacts to the water quality of Fish Creek Reservoir and Fish Creek are analyzed. Potential impacts during construction activities and future use of the recreational facilities at the reservoir are discussed (see Sections 3.3.4 and 4.3).

1.6.2.5 Recreation

Concern was expressed during the scoping process that existing recreational facilities and resources would be impacted during the implementation of the proposed plan. Impacts to recreational facilities, including the existing camping facilities are discussed for the proposed expansion project and for project alternatives. Impacts to the recreation resource are also discussed (see Sections 3.9 and 4.9).

1.6.2.6 Transportation

Impacts to the transportation system from construction equipment and long-term impacts, due to potential increased utilization of the reservoir area, are evaluated. Operation plans are described and mitigation measures discussed (see Sections 3.10 and 4.10).

1.6.2.7 Visual Resources

The Forest Service desires to maintain, and where possible, enhance the visual quality of the area. Visual resources are evaluated and impacts to these resources are disclosed for the proposed action and for all alternatives. Mitigation measures are also presented (see Sections 3.11 and 4.11).

1.6.2.8 Cultural Resources

Cultural resources are surveyed and potential impacts to these resources are evaluated and discussed for the proposed action and all alternatives. Results of the Class III cultural survey are presented (see Sections 3.12 and 4.12).

1.7 EIS ORGANIZATION AND FORMAT

This EIS has been organized and formatted consistent with applicable NEPA and Council on Environmental Quality (CEQ) guidelines to provide the reader with a clear understanding of the proposed action and alternatives, the environmental resources which may be affected, the potential environmental consequences, and the environmental review and evaluation process. This document has been formatted to simplify use with a full Table of Contents and numeric headings, designating the Chapter and section/sub-section. The following are the chapter titles for this EIS document with a brief description of chapter contents.

- Summary - This summary highlights significant information presented in the EIS including the proposed action, alternatives considered, primary impacts, areas of concern, and affected environment.

- Chapter 1 - Purpose of and Need for Action - This chapter introduces the EIS document by briefly describing the Proposed Action; explaining the purpose of the EIS; identifying the agencies involved in the environmental review process, along

with their roles and responsibilities; describing public involvement aspects; summarizing project issues and concerns; and presenting the scope of the analysis.

- **Chapter 2 - Alternatives Including the Proposed Action** - This chapter discusses the Proposed Action in detail; describes all alternatives considered; identifies alternatives eliminated from detailed consideration and explains why they were eliminated; and identifies management, mitigation, and monitoring measures to be considered in evaluating alternatives. This chapter also identifies the Forest Service Preferred Alternative.

- **Chapter 3 - Affected Environment** - This chapter identifies and describes existing resource values and discusses the nature and importance of these values in the context of both the project area and regional environment.

- **Chapter 4 - Environmental Consequences** - This chapter evaluates potential effects of the project proposal and alternatives; addresses the effectiveness of proposed protection/mitigation measures in limiting potential adverse effects; identifies and discusses any unavoidable adverse impacts; and describes consistency with applicable land management plans and policies.

- **Chapter 5 - List of Preparers** - This chapter identifies all agency, proponent, and contractor personnel involved in preparation of the EIS document, along with their title and role in document preparation.

- **Chapter 6 - List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent** - This chapter identifies federal, state and local agencies and members of the public who have been involved in the EIS process and who have received a copy of the EIS.

- **Appendices** - The appendices provide relevant information and analytical data in support of the information, analyses, and conclusions presented in the EIS document.

- **Index** - The index provides an alphabetical key to relevant EIS topics and references their page location within the EIS.

- **Glossary** - The glossary provides the definitions of unfamiliar resource area and NEPA terms and acronyms utilized in the EIS.

- **References** - The reference list presents all published and unpublished reference sources and personal contacts used in developing the EIS. The reference list is organized in a standard bibliography format.

CHAPTER 2

PROPOSED ACTION & ALTERNATIVES

CHAPTER 2 - PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

The purpose of this chapter is to identify and describe the alternatives (potential actions), associated with the Fish Creek Reservoir expansion proposal, including the Proposed Action and the No Action alternatives. Under NEPA, agencies must:

> *"...rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which are eliminated from detailed study, briefly discuss the reasons for their having been eliminated (40 CFR 1502.14 (a))."*

This chapter describes the alternatives selected for detailed study and identifies those alternatives eliminated from detailed study. A discussion explaining why certain alternatives were not studied in detail is included. This chapter also summarizes the environmental consequences of the alternatives analyzed in detail.

The alternatives to a Proposed Action must also include *"...reasonable alternatives not within the jurisdiction of the lead agency (40 CFR 1502.14(c))."* In meeting this intent, there are two separate sets of alternatives analyzed and described in this EIS:

a) Those alternatives from which the Forest Service has the authority to select; and

b) Those alternatives that are not within the jurisdiction of the Forest Service, but are available to the project Proponent, the City of Steamboat Springs and Mt. Werner.

The complete list of the alternatives that were available to the Forest Service to consider is listed below. Several of the alternatives identified have been eliminated from detailed study and are described in greater detail in Section 2.2.

- No Action

- Fish Creek Reservoir Alternatives
  - Fish Creek Reservoir Expansion (Proposed Action)
  - Smaller Fish Creek Reservoir Expansion
  - Larger Fish Creek Reservoir Expansion
  - Fish Creek Reservoir Deepening

- Additional Fish Creek Basin Reservoir Alternatives
  - Long Lake Reservoir Expansion
  - Wren Reservoir Construction
  - Nash Reservoir Construction

- Yampa River Reservoir Alternatives
  - Stagecoach Reservoir Expansion
  - Lake Catamount Expansion

- Other Basin Reservoir Alternatives

Alternatives that are not within the jurisdiction of the Forest Service, but are available to the project Proponent, the City of Steamboat Springs and Mt. Werner include:

- Water Conservation
- Infiltration Gallery Expansion

The Forest Supervisor may select from the range of alternatives available to the Forest Service and may also modify the alternatives by applying certain options to the alternative selected. Project alternatives analyzed in detail by the Forest Service are discussed in Section 2.3. Options available to the action alternatives are presented in Section 2.4. Section 2.5 displays a matrix comparison of the impacts associated with the alternatives analyzed in detail. Identification of the preferred alternative is made in Section 2.6. The remaining alternatives available to the Proponent are evaluated in Section 2.7.

2.2 PROJECT ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

As the analysis began, the total range of alternatives was investigated. As the analysis developed, many of the alternatives considered were eliminated from detailed study by the Forest Service, based on technical, environmental, economic, legal, and/or regulatory factors. Those alternatives eliminated from detailed study are listed below:

- Larger Fish Creek Reservoir Expansion
- Fish Creek Reservoir Deepening
- Long Lake Reservoir Expansion
- Wren Reservoir Construction
- Nash Reservoir Construction
- Stagecoach Reservoir Expansion
- Lake Catamount Expansion
- Other Basin Reservoir Alternatives

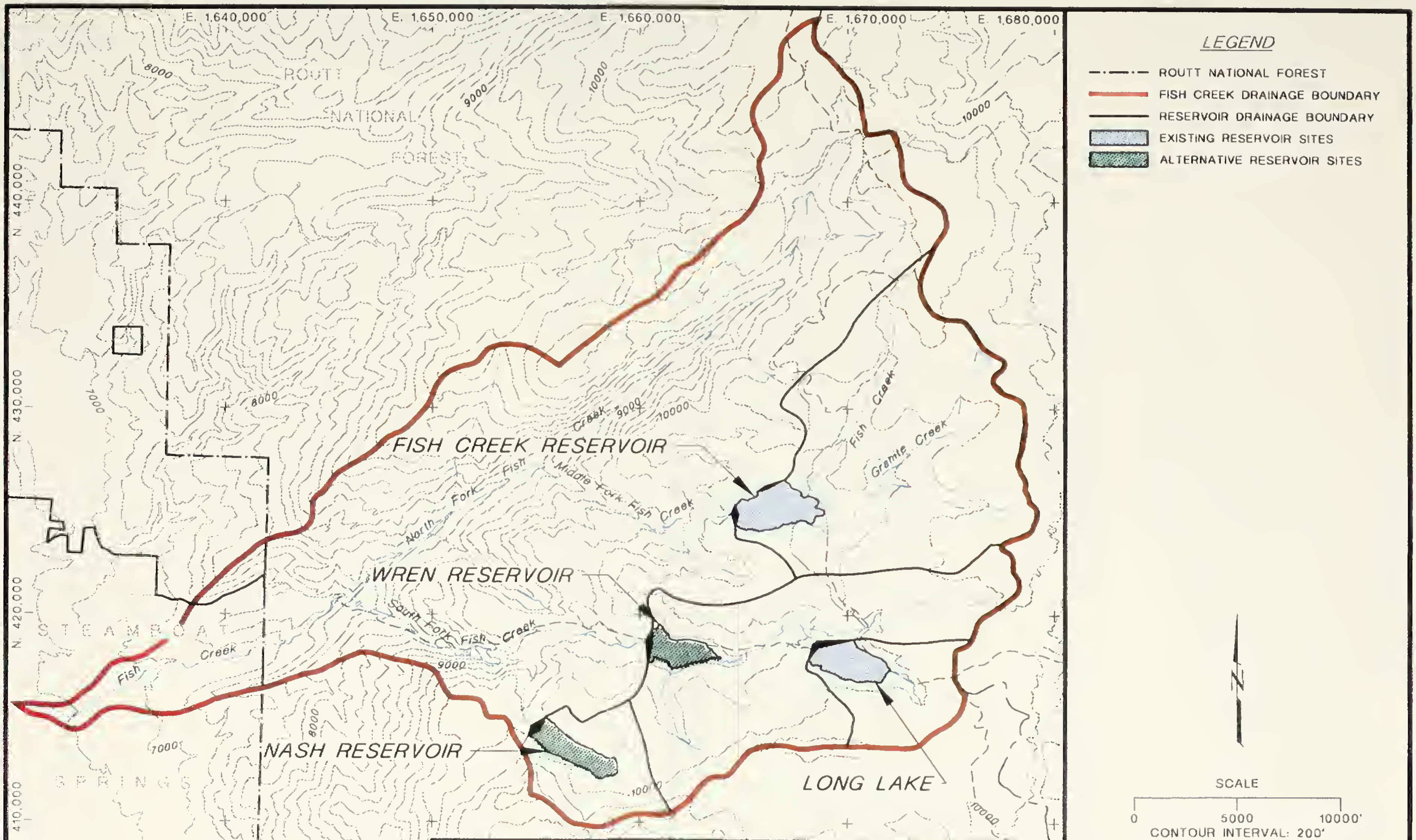
Following is a summary explaining the rationale for elimination of these alternatives from detailed study.

2.2.1 Larger Fish Creek Reservoir Expansion

2.2.1.1 Background

Fish Creek Reservoir is located on the Middle Fork of Fish Creek, about seven miles east of the Steamboat Springs. The reservoir currently has a storage capacity of approximately 1,842 AF and a surface water area of about 90 acres (WCC, 1992a). It is filled by snowmelt and runoff from a five square mile drainage basin. A site location map is presented in Figure 2-1, Fish Creek Basin Reservoir Alternatives.

The original embankment of the main dam was constructed in 1954-1955, with a spillway at the location of the existing saddle dam. The main dam was reportedly raised in the late 1950's and again in 1973. The saddle dam was constructed during the 1973 raise at the location of the original spillway (Chen, 1982).



Project No.: 828-1500	Design By: J. RAY	Scale: SEE SCALE BAR
File: FC2RESA.DWG	Drawn By: T. SMITH	Date: January, 1993

FISH CREEK RESERVOIR EIS

FISH CREEK BASIN RESERVOIR ALTERNATIVES

FIGURE 2-1

In the early 1980's, the City evaluated a third enlargement of the existing Fish Creek Reservoir (D&D, 1983). Their evaluation was based on studies of the existing site topography, spillway location, available construction materials, storage quantities, low flow predictions and geotechnical conditions. Three alternative enlargements were investigated that would provide additional storage of 908 AF, 2,000 AF, and 3,050 AF, respectively. The 3,050 AF reservoir expansion evaluated by the City is referred to as the Larger Fish Creek Reservoir Expansion. Based on the original study performed by Dismuke and Dismuke Inc. (D&D, 1983), large scale expansion of the Fish Creek Reservoir would have the following design characteristics:

- The reservoir would have a total storage capacity of approximately 4,890 AF (an increase of approximately 3,050 AF) and cover a surface water area of about 150 acres (an increase of about 60 acres)
- Dam structures would be raised by expanding the downstream embankments with rock fill
- The main dam for the reservoir would have a total length of about 900 feet (an increase of 250 feet) and a crest height of about 79 feet (an increase of 24 feet)
- The saddle dam would have a total length of about 1,000 feet (an increase of 600 feet) and a crest height of about 42 feet (an increase of 26 feet)
- A spillway would be constructed adjacent to the saddle dam
- Borrow materials would be provided by a proposed rock quarry between the main and saddle dams and an earth-fill area south of a previous mined borrow area below the main dam

In a more recent study, the City and Mt. Werner evaluated a 2,280 AF increase in the storage capacity of Fish Creek Reservoir (WCC, 1992a). This is the Proponent's Proposed Action (Alternative B) in the EIS, and is discussed further in Section 2.3.2.

2.2.1.2 Basis for Elimination

The Larger Fish Creek Reservoir Expansion was examined initially as a viable alternative. However, as the analysis proceeded, several factors became apparent that caused the Forest Service to eliminate it from detailed study. The increased storage capacity provided by this alternative would exceed the purpose and need of the Proposed Action (Alternative B). Additionally, past studies indicate that the unit cost ($/AF) for the construction of the larger expansion is greater than the unit cost of the proposed expansion under Alternative B. The Larger Fish Creek Reservoir Expansion would also result in impacts to an estimated 30 acres of wetlands. These wetlands would potentially be impacted, either by inundation or by removal of material from borrow areas. A section of the dam access road would be inundated and a new road would have to replace the inundated area to provide access to a trailhead and the main and saddle dams.

2.2.2 Fish Creek Reservoir Deepening

To reduce the amount of wetlands potentially impacted by reservoir expansion, it was proposed at a public scoping meeting that Fish Creek Reservoir be deepened to increase its storage capacity. Under Alternative B, some deepening of the existing reservoir is projected to occur in the proposed

borrow areas. Geotechnical analyses indicate, however, that the bedrock nature of the reservoir precludes its deepening to the extent required to meet the storage needs of the Proponent.

Geotechnical explorations in the reservoir area have identified bedrock, at or near the surface. The excavation of the bedrock, as part of a reservoir deepening program, would require drilling and blasting operations to properly fragment the rock for disposal. Blasting of the bedrock within the reservoir would result in noise and flyrock conditions. Excavated materials would have to be removed from the site.

Blasting within the reservoir could also increase fracture flow conditions and, therefore, decrease water volume within the reservoir due to vertical infiltration into the underlying bedrock. Due to the engineering difficulty and viability of this action, this alternative was eliminated from further consideration.

2.2.3 Long Lake Reservoir Expansion

2.2.3.1 Background

Long Lake Reservoir is located on a tributary to Fish Creek, about seven miles east of Steamboat Springs. This reservoir has an active storage capacity of about 400 AF and a surface water area of approximately 60 acres (Birch, 1992a). A site location map is presented in Figure 2-1, Fish Creek Basin Reservoir Alternatives.

The dam for the reservoir is about 475 feet in length with an average height of 9 feet. The spillway channel is about 10 feet wide, with an effective width of several hundred feet. This dam and spillway were reportedly constructed before the Fish Creek Reservoir was built and, since that time, have had various repairs and additions. The most recent repairs occurred in the Fall of 1986. During this time, the dam crest was reshaped and lowered to a uniform height and the reservoir embankments were flattened and/or filled. In addition, the access road between Fish Creek and Long Lake Reservoirs was restored and sections were upgraded (D&D, 1986).

The City currently uses the Long Lake Reservoir to augment their water supply. In addition, Long Lake Reservoir acts as a backup water source when Fish Creek Reservoir requires maintenance (Birch, 1992a).

2.2.3.2 Basis for Elimination

Long Lake Reservoir was not considered for detailed study by the Forest Service for the following reasons:

- The relatively small drainage area that fills the reservoir (0.71 square miles), is insufficient to meet the purpose and need of the Proposed Action.

- Due to its long dam crest, reservoir expansion would be technically difficult and economically prohibitive

- Wetlands impacted would be greater than those impacted under the Proposed Action

- Flow through Fish Creek Falls would be impacted

2.2.4 Wren Reservoir Construction

2.2.4.1 Background

The Wren Reservoir site is located in the upper part of the Fish Creek drainage, about four miles east of the City as shown in Figure 2-1, Fish Creek Basin Reservoir Alternatives. A field inspection of the reservoir site was made in August 1983, by Mt. Werner and its engineer. Based on the 1983 field visit, the following general information was collected regarding the Wren site and the design of a potential reservoir:

- The drainage basin covers an area of approximately 4.8 square miles and ranges in elevation from about 10,400 feet at the upper reaches to 9,480 feet at the dam site

- About 70 to 80 percent of the basin is wooded

- The dam for the reservoir would be about 180 feet in length at the base, 600 to 800 feet long at the crest, and 60 to 80 feet in height

- A spillway would be provided by development of small side drainage about 500 feet south of the embankment or construction of a concrete spillway

- The reservoir would have a storage capacity of approximately 3,210 AF

- Access would be provided by improving an existing road from Fish Creek Reservoir to Long Lake, regrading an old road from Long Lake, and constructing 1/2 mile of new road to the reservoir

- Likely soil borrow areas exist along side slopes of the proposed reservoir and on the ridge above the north abutment of the dam (D&D, 1983).

2.2.4.2 Basis for Elimination

The Forest Service has eliminated development of the Wren Reservoir Site from detailed study for the following reasons:

- The site is presently undeveloped and unimpacted
- A relatively large area of wetlands (approximately 30 acres) would be inundated
- Flow through Fish Creek Falls would be impacted
- Access would be difficult and a heavily-used recreation trail would be inundated
- An unroaded setting would be converted to a developed site

2.2.5 Nash Reservoir Construction

2.2.5.1 Background

The Nash Reservoir site is located on a tributary of the South Fork of Fish Creek, about five miles east of the City, as shown on Figure 2-1, Fish Creek Basin Reservoir Alternatives. It occurs in a small glacial valley just below the Steamboat Ski Area.

Development of a reservoir at this site was first proposed to the Forest Service in November 1968. In June 1971, an application was submitted again to construct a reservoir on Forest Service lands, but was denied at that time, based on the findings presented in a Forest Service Environmental Analysis Report (EAR). The EAR, completed in June 1973, identified several items that needed further analysis by the Applicant, including a larger reservoir design to meet fishery concerns; evaluation of the watershed potential and low flow requirements; and the construction of an access road (Reed, 1990).

Additional applications were submitted to the Forest Service in June 1980 and May 1987. The 1987 application proposed a much larger reservoir at the site than the previous designs and included construction of an access road and an analysis of cultural and wetland resources. In 1989, the Forest Service concluded that the following concerns needed to be addressed:

- Updated estimate of construction and maintenance costs
- A project need (identification of potential market(s) for the water)
- A cost/benefit analysis for the project
- Submittal of a 404 permit application with the U.S. Army Corps of Engineers (Reed, 1989)

According to the Forest Service, no analysis on developing this reservoir is being prepared at this time (Reed, 1990).

Based upon the 1987 Special Use Application submitted to the Forest Service, the proposed Nash Reservoir would have the following design characteristics:

- The dam for the reservoir would be about 500 feet in length and 35 feet in height and have a storage capacity of 760 AF

- The reservoir would inundate approximately 30 to 40 acres of National Forest Land with soil borrow areas below the high water line

- The dam structure would consist of earth fill embankments faced with rock and drainage would be provided by a bottom-water overflow outlet

- A 1.25 mile access road would be constructed from the existing road which services the Steamboat Ski Area and the transmission tower atop Mt. Werner

2.2.5.2 Basis for Elimination

The Forest Service has eliminated development of the Nash Reservoir Site from detailed study in this EIS for the following reasons:

- The site is presently undeveloped and unimpacted
- The 760 AF storage volume would not meet the proposed purpose and need
- A larger amount of wetlands would be inundated than under the proposed action
- Flow through Fish Creek Falls would be impacted
- Access would be extremely difficult
- The Proponent does not own any water rights to the proposed Nash Reservoir

2.2.6 Stagecoach Reservoir Expansion

The Stagecoach Dam, constructed in the summer of 1988, was designed to meet the agricultural water demands of the Upper Yampa Water Conservancy District (UYWCD), and as a recreational facility. The dam is a roller compacted concrete (RCC) structure 145 feet high and 360 feet long. To enhance the downstream fishery in the Yampa River, the dam includes a multi-level intake tower that pulls water from various depths in the reservoir. The reservoir has a storage capacity of 33,275 AF. Both the City and Mt. Werner lease storage rights in Stagecoach Reservoir primarily as a back-up water source to the Fish Creek basin water.

2.2.6.1 Basis for Elimination

The Stagecoach Reservoir Expansion was eliminated from detailed analysis by the Forest Service because construction activities have recently been completed at the reservoir site and virtually new facilities would be inundated by an expansion. The intake of water from Stagecoach Reservoir to the City and Mt. Werner's water system would likely be through the existing infiltration galleries. This would require expansion of the infiltration galleries, and subsequently, expansion of the water treatment and distribution facilities. Additionally, due to water quality concerns, both the City and Mt. Werner have minimized the use of the infiltration galleries. These concerns are discussed further in Section 2.7.2.

2.2.7 Lake Catamount Expansion

2.2.7.1 Background

Lake Catamount, constructed in 1977-1978, is a privately-owned lake, utilized primarily for recreational purposes. It is integral to the proposed Lake Catamount Resort development and, therefore, is not available as a water source to the City or Mt. Werner.

2.2.7.2 Basis for Elimination

The Proponent has no water storage rights to Lake Catamount. For this reason, this alternative was eliminated from further consideration by the Forest Service. As the water intake for this alterative would likely be through the infiltration galleries, the concerns expressed in Section 2.2.6 and in Section 2.7.2, associated with the expansion of the infiltration galleries, are also relevant to this alternative.

2.2.8 Other Basin Reservoir Alternatives

2.2.8.1 Background

In 1990, the Colorado River Water Conservation District (CRWCD) began a study of alternative water storage supply locations in the Yampa River Basin (Hydrosphere, 1990). Potential reservoir sites were considered, based on their ability to serve both near-term (25-year) and long-term (50-year) demand projections. A near-term site was proposed in the Craig, Colorado area to provide storage and recreation, with a long-term site located in the upper part of the basin to retain water rights for future in-basin uses (CRWCD, 1991a).

A total of 64 reservoir sites were initially identified by the CRWCD through review of previous studies, examination of topographic maps of the area, and discussions with local water supply experts (CRWCD, 1991a). The original sites underwent a screening process to identify sites to be analyzed in further detail. Screening criteria specified that the reservoir must have sufficient inflow and topography to support a minimum reservoir size of 20,000 AF; must be outside of habitat areas of threatened and endangered fish species; and must not have obvious engineering and environmental flaws (CRWCD, 1991b). At a public meeting held in Craig in July 1992, it was recommended that five of these sites be given further consideration:

- Elkhead Reservoir Expansion
- Williams Fork near Hamilton
- East Fork
- Elk Creek
- Stagecoach Reservoir Expansion

Enlargement of the existing Stagecoach Reservoir, not originally identified by the CRWCD as an alternative site, was added in response to public comment.

2.2.8.2 Other Basin Reservoir Alternatives Considered for this Proposal

For the purpose and need stated in this EIS, only three of the reservoir sites identified by the CRWCD study are relevant:

- Walton Creek
- Fish Creek Reservoir Expansion
- Stagecoach Reservoir Expansion

Two of these sites (Walton Creek and Fish Creek) were in the original CRWCD list of 64 potential reservoir sites. Stagecoach Reservoir is the only one of these three sites on the final list being considered by CRWCD.

2.2.8.3 Basis for Elimination

Walton Creek is eliminated from detailed study by the Forest Service primarily because of the anticipated expense of reservoir construction and of water conveyance and treatment. CRWCD has estimated that active storage in a reservoir on Walton Creek would cost approximately $6,500 per AF compared to a cost of approximately $2,600 per AF for the proposed Fish Creek Reservoir Expansion (CRWCD, 1992). Expansion of Stagecoach Reservoir is discussed in Section 2.2.6. Development of reservoir sites within the Fish Creek basin are described in several sections within this chapter.

2.3 PROJECT ALTERNATIVES ANALYZED IN DETAIL BY THE FOREST SERVICE

The following alternatives were considered in detail by the Forest Service. These alternatives are available for selection by the Forest Supervisor:

- Alternative A - No Action
- Alternative B - Fish Creek Reservoir Expansion (Proposed Action)
- Alternative C - Smaller Fish Creek Reservoir Expansion

Alternatives analyzed and available to the Proponent include:

- Conservation
- Infiltration Gallery Expansion

Alternatives available to the Forest Service are discussed below and those available to the Proponent are described in Section 2.7.

2.3.1 Alternative A - No Action

2.3.1.1 Background

NEPA requires that a No Action Alternative be considered in all environmental documents. This alternative serves as the baseline for estimating the impacts of the other alternatives presented in the EIS. For the purposes of this analysis, the No Action Alternative describes the current condition of the reservoir. Under this alternative, a new Special Use Permit would not be granted by the Forest Service to expand the existing Fish Creek Reservoir and the City would continue to operate the reservoir under its existing Special Use Permit. In this instance, the No Action Alternative would require that the Proponent consider other means of meeting projected water demands and storage requirements, and providing in-stream flow. As discussed in Section 2.7, implementation of water conservation measures and expansion of the existing infiltration galleries are alternatives available for implementation by the Proponent.

Under the No Action Alternative, the existing dam structures, reservoir, and ancillary facilities would remain virtually unchanged. As shown in Figure 2-2, Alternative A - No Action, the reservoir is impounded by two embankments, the main dam and the saddle dam. The main dam is a homogeneous earth-fill embankment with a maximum height of 55 feet and a crest length of about 650 feet. The saddle dam, located northeast of the main dam, is a zoned earth-fill embankment with a maximum height of about 16 feet and a length of approximately 400 feet. The spillway for the reservoir is located at the right abutment of the saddle dam, providing capacity for both service and emergency flows. The existing outlet conduit is located at the main dam and consists of a 24-inch diameter steel pipe with an upstream control gate (Chen, 1982).

2.3.1.2 Environmental Consequences

Environmental consequences include all physical, social, economic, cultural, recreational, and visual impacts associated with the implementation of an alternative. Assuming that the No Action alternative describes the current condition of the reservoir, and that no corrective action has yet been taken by the Forest Service under the terms of the existing permit and/or operating plan, the environmental consequences associated with the implementation of the No-Action Alternative include the following:

- Continued degradation of Puppy Dog Lake drainage
- No additional water supply or storage capacity
- No remote operational control of the raw water system
- No early warning system to alert City and residents of dam safety conditions
- No in-stream flow augmentation and control
- No long-term conservation pool for maintenance of fisheries, recreational activities, and scenic beauty

- Potential impact on socioeconomic climate if lack of water restricts growth
- Continued degradation of service roads
- Continued degradation of campground facilities

A further examination of impacts is presented in Section 2.5, Comparison of Alternatives Analyzed in Detail and in Chapter 4, Environmental Consequences.

2.3.1.3 Potential Mitigation

The Forest Service could modify the existing Fish Creek Reservoir permit and/or operating plan to address the environmental consequences of the No Action Alternative. Potential mitigation under the No Action Alternative could include:

- Development of additional water supplies (through encouragement of water conservation programs, alternative storage, increased usage of infiltration galleries, etc.)

- Erosion protection in the Puppy Dog Lake drainage

- Upgrade of Granite Campground

- Upgrade of service roads

- Design and implementation of early warning and remote operational control systems

At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event, however, that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further addressed by the Forest Service.

2.3.2 Alternative B - Proposed Reservoir Expansion (Proposed Action)

2.3.2.1 Background

The present design and operation of the Fish Creek Reservoir is discussed briefly under the No Action Alternative and in more detail in Section 3.2 (Dam Safety/Flood Hazard) and Section 3.3 (Water Resources). The City and Mt. Werner recently evaluated a 2,280 AF increase in the storage capacity of the reservoir (WWC, 1992a&b). This increase in storage capacity is the Proposed Action (Alternative B) in the EIS, and is shown in Figure 2-3, Alternative B - Fish Creek Reservoir Expansion (Proposed Action).

2.3.2.2 Reservoir Design

Based on the studies performed by Woodward-Clyde Consultants (WCC, 1992a&b), Alternative B would have the following basic design characteristics:

- The reservoir would have a total storage capacity of approximately 4,122 AF (an increase of 2,280 AF) and cover a surface water area of about 140 acres (an increase of approximately 50 acres)

Project No.: 828-1500	Design By: J. RAY	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC2NO.DWG	Drawn By: T. SMITH	Date: January, 1993	
FIGURE 2-2			ALTERNATIVE A NO ACTION ALTERNATIVE

Project No.: 828-1500	Design By: J. RAY	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC2APP.DWG	Drawn By: T. SMITH	Date: January, 1993	

FIGURE 2-3

ALTERNATIVE B
FISH CREEK RESERVOIR EXPANSION
(PROPOSED ACTION)

- The main dam for the reservoir would be raised by removing a top portion of the existing structure and constructing new fill on the upstream of the existing embankment

- The main dam would have a total length of about 830 feet (an increase of 180 feet) and a crest height of about 75 feet (an increase of 20 feet)

- The existing saddle dam would be removed and replaced with an earth fill embankment with a total length of about 1060 feet (an increase of 660 feet) and a crest height of about 40 feet (an increase of 24 feet)

- An 80-foot wide spillway would be cut into bedrock on the right abutment of the new saddle dam

- A new, high level outlet works would be constructed for normal reservoir operation and, along with the existing outlet, would provide a means of draining the reservoir during an emergency. The existing outlet pipe would be extended and rehabilitated. The outlet works would be operated to reduce flow into the Puppy Dog Lake drainage during spring runoff.

The proposed reservoir expansion under Alternative B, would involve complete drawdown of the reservoir and diversion of Granite Creek during construction. Construction would be completed in two seasons.

Integral to the dam design is the installation of a remote operational control system. The existing Fish Creek Reservoir is situated in a remote location which is practically inaccessible from November through June each year. Releases from the reservoir are currently made by manual adjustments to the outlet gate. Under the best conditions, this requires about a half day to complete. Adjustments are not possible under adverse conditions, resulting in reservoir releases in excess of actual demands. The remoteness and inaccessibility of the reservoir also hinder detection, and possibly correction, of problems that could threaten the structural integrity of the dams. To correct these deficiencies, the Proponent proposes to install a system that allows remote operation of the outlet works of the reservoir. In addition, a remote data acquisition system would be installed to provide adequate warning of problems that arise that could threaten the integrity of the structures. This system would monitor the internal pressures of the main dam and saddle dam, and would measure the flow downstream from these structures.

2.3.2.3 Environmental Consequences

The environmental consequences associated with the implementation of Alternative B include the following:

- Disturbance and loss of wetlands, upland meadows, mixed conifer forests, and previously undisturbed areas

- Increased capability to detect and remediate problems with the dams due to the installation of an early warning monitoring system

- Remote operation of reservoir outlet gate to respond to any detection of imminent dam failure and provide year-around operation capability.

- Reduction of erosion problems currently associated with Puppy Dog Lake drainage
- Ability to store additional water and meet future water demands
- Augmentation of in-stream flows below the intake to the water filtration plant
- Increase in high mountain lake habitat for fish and reduction of stream habitat for fish at the reservoir site
- Depletion of water for downstream endangered fish species habitat
- Temporary displacement of Fish Creek Reservoir visitors and other recreationists in the area during construction
- Permanent alteration of the recreation setting of Fish Creek Reservoir due to relocation and upgrading of Granite Campground and improved access
- Change of campground use from non-fee area to fee area because of potable water supply
- Temporary impacts to road conditions and transportation safety along Forest Development Road (FDR) 60 & 310 during construction

A further examination of impacts is presented in Section 2.5, Comparison of Alternatives Analyzed in Detail and in Chapter 4, Environmental Consequences.

2.3.2.4 Potential Mitigation

In the event that Fish Creek Reservoir is expanded under Alternative B, a number of mitigation efforts would be required. A more comprehensive mitigation plan would be developed between the Draft EIS and the Final EIS. Mitigation would include the following:

- Wetlands which would be disturbed by the expanded shoreline, borrow areas, and new transportation routes would be restored or replaced according to requirements of COE Section 404 (c) permit guidelines
- Soil resources which would be affected by construction-related activities would be reclaimed through soil reclamation programs. Disturbed areas above the high water line would be revegetated
- Authorized activities within the construction area would be limited under the terms of the Special Use Permit (ie. firearms, firewood, fishing limits, etc.)
- Granite Campground (including the campsites, parking area, picnic tables, etc.) would be relocated above the new high-water line, and designed such that potential campground-related impacts to the water quality of the reservoir would be minimized and the recreational experience enhanced. This facility would comply with the Uniform Federal Accessibility Standards of the American Disabilities Act (ADA)

- In order to minimize the probability of an automobile, hiker, or bicycle accident along FDR 60 and 310, safety measures would be implemented during the mobilization of heavy equipment and the transportation of supply vehicles to and from the project site (a discussion of safety measures appears in Section 4.10, Transportation)

- An approved emergency hazardous waste spill response plan (describing procedures to be implemented in case of a fuel or hazardous waste spill) would be submitted by the Proponent before any fuel or hazardous material is transported over the West Route. A similar plan would be prepared for utilization of explosives.

- To minimize the impacts to the road conditions along the West Route, the Proponent would submit and implement a road maintenance plan which ensures that the surface of the roads are returned to the same or better condition as they were prior to the transportation of construction-related equipment

- Under Alternative B, water conservation would also be encouraged by the Forest Service and the Proponent

- Visual mitigation would be incorporated into the design and, where possible, the visual aspects of the project (including structures, parking areas, roads, borrow areas) would be improved to meet the Visual Quality Objectives of the Forest Service

2.3.3 Alternative C - Smaller Reservoir Expansion

2.3.3.1 Background

As previously stated, in the early 1980's, the City evaluated three alternative increases in the storage capacity of the existing Fish Creek Reservoir: 908 AF, 2000 AF, and 3050 AF (D&D, 1983). The 908 AF increase in storage capacity is referred to in this document as Alternative C - Smaller Reservoir Expansion, and is shown in Figure 2-4.

2.3.3.2 Reservoir Design

Based on the study performed by Dismuke and Dismuke (D&D, 1983), Alternative C would have the following basic design characteristics:

- The reservoir would have a total storage capacity of 2750 AF (an increase of 908 AF) and cover a surface water area of about 112 acres (an increase of about 22 acres)

- Dam structures would be raised by expanding the downstream embankments with earth fill (in contrast to primarily rock fill as proposed for the large scale expansion)

- The main dam for the reservoir would have a total length of about 750 feet (an increase of 100 feet) and a crest height of about 63 feet (an increase of 8 feet)

- The saddle dam would have a total length of about 800 feet (an increase of 400 feet) and a crest height of about 26 feet (an increase of 10 feet)

- A spillway would be constructed adjacent to the saddle dam

2.3.3.3 Environmental Consequences

The environmental consequences associated with this alternative include all of the consequences listed for the proposed reservoir expansion alternative with the exception that less vegetation and fewer wetlands would be disturbed. Although the proposed expansion under Alternative B would meet present and future water demands, it is anticipated that a smaller reservoir expansion would meet only a portion of the future water demands projected for Mt. Werner. Consequently, additional water supplies would have to be developed under Alternative C.

A further examination of impacts is presented in Section 2.5, Comparison of Alternatives Analyzed in Detail and in Chapter 4, Environmental Consequences.

2.3.3.4 Potential Mitigation

In the event that a smaller expansion of Fish Creek Reservoir is permitted, mitigation would be identical to that required for the proposed expansion under Alternative B. Under Alternative C, the implementation of water conservation programs would also be encouraged by the Forest Service and the Proponent.

2.4 OPTIONS AVAILABLE TO THE FISH CREEK RESERVOIR EXPANSION ALTERNATIVES ANALYZED IN DETAIL BY THE FOREST SERVICE

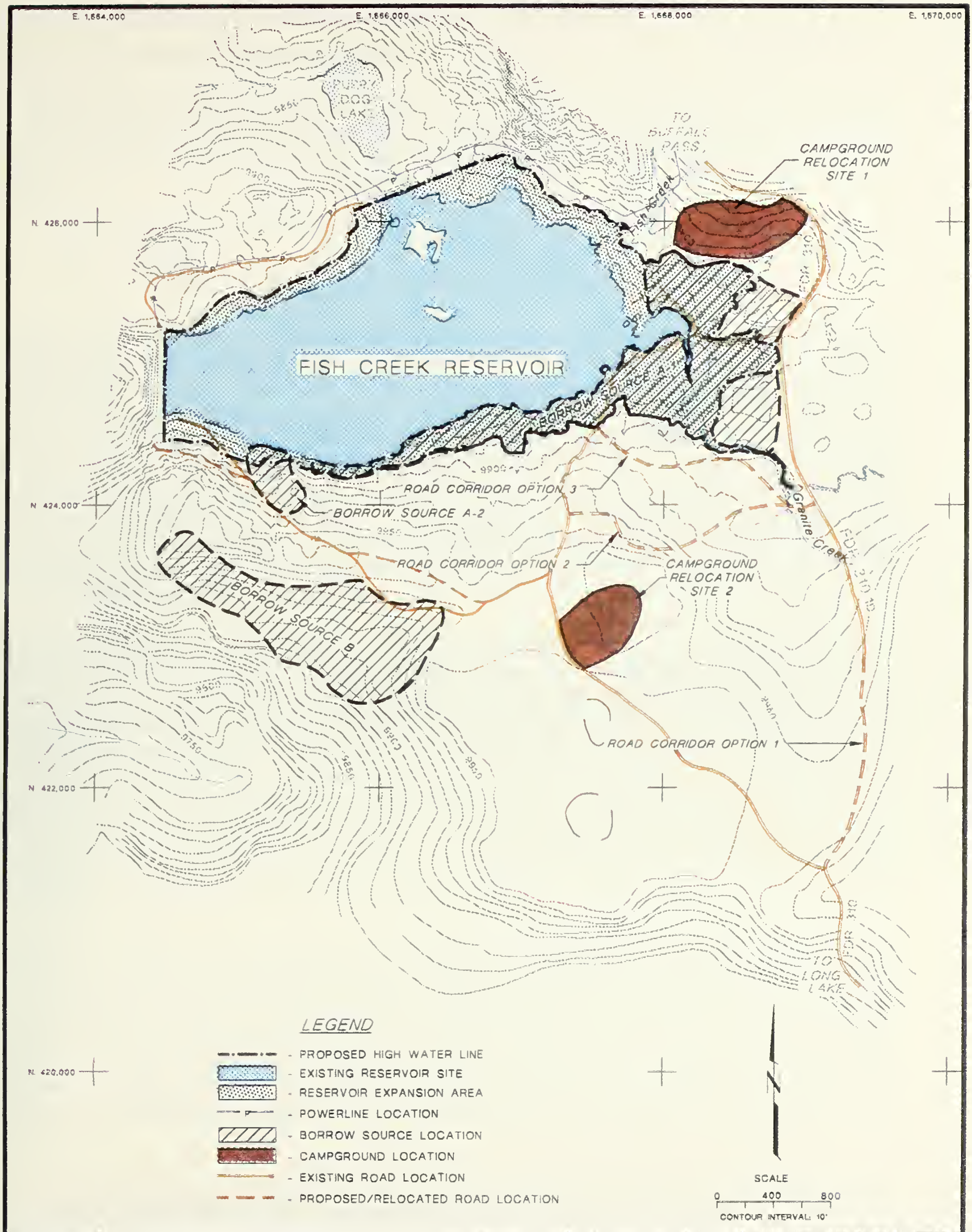
Specific options to the proposed reservoir expansion and the smaller expansion alternatives (Alternatives B and C) were identified during the scoping process. These options include the following:

- Power supply
- Campground relocation sites
- Service roads
- Borrow areas

These options are described in the following paragraphs, and shown in Figure 2-5, Ancillary Facilities. At this time, the underground electric power supply option has been determined to be the most reliable power source for the proposed and smaller reservoir expansions. The two other power supply options have, therefore, been eliminated from further consideration and rationale is provided for elimination. Based upon further analysis, the remaining options may be modified prior to the release of the Final EIS.

Project No.: 828-1500	Design By: J. RAY	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC2SMALL.DWG	Drawn By: T. SMITH	Date: January, 1993	**ALTERNATIVE C SMALLER RESERVOIR EXPANSION**

FIGURE 2-4



Project No.: 828-1500	Design By: J. RAY	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC21AC.DWG	Drawn By: T. SMITH	Date: January, 1993	

FIGURE 2-5

ANCILLARY FACILITIES (ALTERNATIVES B & C)

2.4.1 Power Supply Options Considered

No power supply would be installed under the No Action Alternative. For the proposed (Alternative B) and smaller (Alternative C) reservoir expansions, the power supply needed to operate the remote reservoir control system and the early warning system, could be supplied by one of three sources:

- Electric
- Solar
- Propane

The City and Mt. Werner are proposing an electric powerline to the site to meet the power demands of the proposed early warning and remote operation systems. The electrical service would also be utilized during construction activities. The proposed design includes an underground 7,200 volt service to the Fish Creek dam and potential campground site. The alignment of the power line is shown in Figure 2-5, Ancillary Facilities. The power cable, which is encased in flexible conduit, would be placed in the existing roadway and would be buried in a 30-36 inch deep trench. A 7,200 volt service, provided by Yampa Valley Electric Association (YVEA), is presently available adjacent to the Summit Lake - Fish Creek roadway at the point where the Hayden-Cheyenne hi-line crosses the road. The total distance to the proposed control house is approximately 19,000 feet (3.71 miles). Approximately every 1,250 feet, a small green cubicle would be installed by the side of the road for grounding purposes and access to the cable.

Another power option considered includes photovoltaic solar collectors. The principle involved is the conversion of heat from the sun into electrical energy. For example, a photovoltaic generator 16 feet wide and 12 feet high will generate, when the sun is shining, about 1.44 kilowatts used to charge 24 volt batteries. Stored energy from the batteries would theoretically provide the power to drive a remote warning system and to operate the 36-inch dam outlet valve. Reliability of this system is of major concern. It depends on the solar resource at the Fish Creek Dam which is predicted to be about 30 percent of a comparable installation in sunny New Mexico. Secondly, the amount of power required to operate a 10 horsepower motor-operated gate operator is difficult to obtain from even a large bank of batteries. These batteries can be unreliable at sub-zero temperatures. In addition, the collector might be considered visually objectionable and it could easily be damaged.

Propane is another power source option considered. This system would require an internal combustion engine driving a relatively large generator with an output rating of 20 to 25 kilowatts. Batteries, subject to below zero temperatures, would be required for starting the engine. Batteries under these conditions, coupled with the requirement to start the motor-generator by remote control by radio, would not provide the reliability essential to this application. Additionally, a 1,000-gallon high-pressure liquid propane storage tank would be visually objectionable. Concerns over temperature fluctuation, storage, and public safety would limit the usefulness of propane in this application.

As stated previously, the underground electric power supply option has been determined to be the most reliable power source for the proposed and smaller reservoir expansions. The solar and propane options have, therefore, been eliminated from further consideration.

2.4.2 Campground Relocation Site Options

As part of both Alternative B and Alternative C, the existing Granite Campground would be replaced by an upgraded camping area in one of two potential locations, as shown in Figure 2-5, Ancillary Facilities. Campground Relocation Site 1, is on the northeast shoreline of the expanded reservoir, near the site of the existing campground. Campground Relocation Site 2 is on the south side of the reservoir. Under the No Action Alternative, the campground would not be relocated. The new campground in either location, under Alternatives B or C, would provide the following facilities:

- Two-way entrance road
- Double lane camping access road
- 15 vehicle gravel parking lot
- 4 tent sites with 4 or more future sites
- 4 vehicle access sites with 4 future sites
- 2 picnic sites
- Concrete boat ramp
- Composting toilet
- Potable water
- Facility would comply with the Uniform Federal Accessibility Standards of the American Disabilities Act, where applicable.

2.4.3 Service Road Options

No new service roads to the main dam would be constructed under Alternative A (No Action Alternative). For Alternatives B (Proposed Action) and C (Smaller Reservoir Expansion), three alternative road options have been proposed to route FDR 310.2 around the proposed reservoir. All three road options are shown on Figure 2-5, Ancillary Facilities.

Road Option 1 would start at the end of FDR 310.1B and continue south until it reaches FDR 310.2. The proposed road would be constructed through the trees approximately 200 feet from the open meadow.

Road Option 2 would branch off of FDR 310.1B just south of Granite Creek and continue southwest across the meadow until it reaches FDR 310.2.

Road Option 3 would also branch off of FDR 310.1B just south off Granite Creek and would continue west just above the proposed water line until it reaches FDR 310.2

Other proposed transportation plans for Alternatives B and C include the realignment and upgrade of the two track, four-wheel drive access road from FDR 310.2 to the dam and saddle dam. The road would be realigned to bypass environmentally sensitive meadows. Upgrading would include regrading and the addition of drainage structures and gravel.

2.4.4 Borrow Areas

There would be no need to utilize borrow areas under the No Action Alternative. An estimated 300,000 cubic yards of borrow material would be required to expand the Fish Creek Reservoir under Alternative B. Approximately 200,000 cubic yards of borrow material would be required for the smaller reservoir expansion (Alternative C).

Previous studies (WCC, 1991) have identified three potential borrow source areas for embankment material. These areas are identified by A-1, A-2, and B and are shown in Figure 2-5, Ancillary Facilities. According to Woodward-Clyde (WCC, 1992b), Borrow Area A-1 and the current reservoir basin would be utilized as the primary source of embankment material. Borrow Area B could be utilized as a supplemental source of embankment material, if additional material is required or if the moisture content of the material in Borrow Area A-1 is too high. Borrow Area A-2 could be utilized as quarry for additional riprap material, if required. The proposed plan is to utilize borrow material within the enlarged reservoir.

2.4.4.1 Borrow Area A-1

The extent of the Borrow Area A-1 is approximately 36 acres. The soils in Borrow Area A-1 are predominately silty sands, mostly resulting from weathered granite, with some cobbles and occasional boulders. The depth to bedrock varies from 5 to 45 feet with the deepest areas being in the southeast. It is estimated that approximately 400,000 cubic yards of suitable embankment material is available within Borrow Area A-1. Utilization of Borrow Area A-1 could impact approximately 36 acres of undisturbed land, most of which is within the area of inundation.

Under Alternative B, approximately 12.3 acres of wetlands within Borrow Area A-1 would be inundated. Under Alternative C, about 6.6 acres of wetlands within Borrow Area A-1 would be inundated. Neither Alternative B nor Alternative C would impact wetlands acreage in Borrow Area A-1 beyond the proposed inundation area.

2.4.4.2 Borrow Area A-2

Borrow Area A-2 is predominately rock outcrop with bedrock near the surface. As previously stated, this area could be used as a quarry for riprap material, if sufficient riprap is not available from Borrow Area A-1. If the area is used in the construction of the dams, it could disturb up to approximately 3.0 acres of undisturbed land which contains no wetlands. A portion of Borrow Area A-2 would be inundated under Alternatives B and C.

2.4.4.3 Borrow Area B

Borrow Area B would only be used as a supplemental source of suitable embankment material if required. According to Chen (1982), there is approximately 90,000 to 100,000 cubic yards of silty sand, gravel, cobbles and occasional boulders which could be used as borrow material. If this area is used, it could disturb up to 18 acres of undisturbed land which contains no wetlands. As shown on Figure 2-5, Borrow Area B is not adjacent to the reservoir, and therefore, would not be inundated under either the proposed reservoir expansion (Alternative B) or the smaller reservoir expansion (Alternative C).

2.5 COMPARISON OF IMPACTS OF ALTERNATIVES ANALYZED IN DETAIL

The alternatives to the proposed Fish Creek Reservoir Expansion have been developed and evaluated based on the issues identified as part of the public scoping process. Table 2-1 presents a summary of the relative impacts of each alternative, including the No Action Alternative, to the resource area issues identified in the scoping process. A more detailed discussion of impacts is presented in Chapter 4.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
DAM SAFETY/FLOOD HAZARD		
▸ Peak downstream flows in event of flood are 63,200 cfs	▸ Peak downstream flows in event of flood are 136,200 cfs	▸ Peak downstream flows in event of flood are 80,400 cfs
▸ No early warning system, affecting public safety	▸ Increased capability to detect and control problems with dam due to installation of early warning monitoring system	▸ Impacts same as Alternative B except for downstream flows in event of flood
▸ Annual dam inspections by the State could continue. More regular dam inspections would not be performed, affecting public safety	▸ Improved dam stability (static and dynamic) due to improved construction techniques and materials and control of dam seepage	
▸ Operation and control of reservoir outlet by manual adjustments would preclude emergency releases	▸ Remote operation of outlet gate; outlet design allows for operational flexibility and the ability to release larger volumes of water	
▸ Dam service road would continue to degrade, creating access difficulty	▸ Dam access road would be improved, allowing easier access to the dam	
▸ Continued development in flood inundation area would contribute to the flood safety hazard	▸ Continued development in flood inundation area would contribute to the flood safety hazard	

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
WATER RESOURCES		
▸ No additional storage capacity would be provided to the public	▸ Storage capacity of the reservoir would be increased by 2,280 AF	▸ Storage capacity of the reservoir would be increased by 908 AF
▸ Erosion of Puppy Dog Lake Drainage and downstream sedimentation would continue	▸ Degradation of Puppy Dog Lake drainage would be corrected and sedimentation would be reduced	▸ Degradation of Puppy Dog Lake drainage would be corrected and sedimentation would be reduced
▸ Mt. Werner could not meet present or future water demands and would have to develop additional water supplies	▸ Could meet present and future water demands of the City and Mt. Werner	▸ Could meet present and some of future water demands; Mt. Werner would have to develop additional water supplies to meet future demands
▸ No guarantee that additional water supply would be of same water quality as the Fish Creek supply	▸ Could depend entirely on high quality water of Fish Creek Reservoir	▸ No guarantee that additional water supply would be of same water quality as the Fish Creek supply
▸ No in-stream flow augmentation or maintenance of in-stream flows	▸ In-stream flow augmentation and maintenance of CWCB in-stream flow right in lower Fish Creek	▸ Possible short-term in-stream flow augmentation
▸ No long-term conservation pool for fisheries	▸ A conservation pool for fisheries would be maintained	▸ Possible short-term conservation pool
▸ Water quality impacts associated with increased usage of the reservoir (cumulative impact)	▸ Water quality impacts associated with increased usage of the reservoir (cumulative impact)	▸ Water quality impacts associated with increased usage of the reservoir (cumulative impact)

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
SOCIOECONOMICS		
▸ Lack of water resources could potentially limit growth ▸ No early warning system to warn community of a dam failure and flood hazard ▸ More money available for other projects ▸ Capital improvement penalty interest payment of $80,000/year until a decision is made ▸ Community satisfaction with water quality may decrease if an inferior water supply is utilized	▸ Water would not be a limiting resource to growth ▸ Early warning system installed to alert community of dam failure and flood hazard ▸ Total cost of expansion would be $6,000,000 ($2,600 per AF of water) ▸ Construction costs and share of water would be split 75%/25% by Mt. Werner and City, respectively	▸ Lack of sufficient water resources could potentially limit growth ▸ Early warning system installed to alert community of dam failure and flood hazard ▸ Total cost of expansion would be $4,200,000 ($4,600 per AF of water) ▸ Construction costs and share of water to be negotiated by Mt. Werner and City ▸ Community satisfaction with water quality may decrease if an inferior water supply is utilized ▸ Additional money available for other capital improvement projects
WETLANDS		
▸ 0 acres of wetlands would be impacted	▸ 15.09 acres of wetlands would be impacted ▸ At least 22.6 acres of wetlands would be recreated	▸ 8.80 acres of wetlands would be impacted ▸ At least 13.2 acres of wetland would be recreated
SOILS		
▸ 0 acres of soils would be impacted	▸ 60.6 acres of soils would be impacted	▸ 29.6 acres of soils would be impacted
VEGETATION		
▸ 0 acres of vegetation would be impacted	▸ 51.4 acres of vegetation would be lost (includes wetlands, upland meadows, mixed conifer and previously disturbed areas	29.5 acres of vegetation would be lost (includes wetlands, upland meadows, mixed conifer and previously disturbed areas

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
WILDLIFE/FISHERIES		
▸ Stream habitat in Puppy Dog Lake Channel would continue to degrade	▸ Stream habitat in Puppy Dog Lake Channel would be improved	▸ Stream habitat in Puppy Dog Lake Channel would be improved
▸ No long-term conservation pool would be maintained	▸ Long-term conservation pool would be maintained	▸ Short-term conservation pool could be maintained
	▸ Expanded shoreline would inundate 51.4 acres of terrestrial and wetlands habitat which would be irreversibly lost	▸ Expanded shoreline would inundate 29.5 acres of terrestrial and wetlands habitat, which would be irreversibly lost
	▸ Short-term displacement of wildlife due to construction activities	▸ Short-term displacement of wildlife due to construction activities
	▸ High mountain lake habitat for fish is enlarged, but stream habitats would be reduced	▸ High mountain lake habitat for fish is enlarged, but stream habitats would be reduced
	▸ Indirect and minor impacts to endangered species of fish in Colorado River due to modifications of flow releases (timing and quantity) from Fish Creek Reservoir	▸ Indirect and minor impacts to endangered species of fish in Colorado River due to modifications of flow releases (timing and quantity) from Fish Creek Reservoir
	▸ Direct habitat loss may affect four Federal candidate species including the Boreal Toad, Wolverine, Lynx, and Northern Goshawk	▸ Direct habitat loss may affect four Federal candidate species including the Boreal Toad, Wolverine, Lynx, and Northern Goshawk
▸ Increased use of the area would result in more displacement of wildlife (cumulative impact)	▸ Increased use of the area would result in more displacement of wildlife (cumulative impact)	▸ Increased use of the area would result in more displacement of wildlife (cumulative impact)
▸ Fish Creek Reservoir would be restocked with fish	▸ Fish Creek Reservoir would be restocked with fish	▸ Fish Creek Reservoir would be restocked with fish

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
RECREATION		
	▸ Would displace summer visitors to other recreation resources for 2 years	▸ Impacts same as Alternative B
	▸ Use pressures on other recreation resources could increase due to displaced Fish Creek visitors during construction	
	▸ Granite Campground, parking lot, and Shoreline Trail would be inundated	
▸ Existing Granite Campground would remain in its present condition with no upgrade or improvement, resulting in a diminished recreational experience; presently not handicap accessible	▸ New, larger Granite Campground and parking lot would increase visitor capacity of developed facilities and thus accommodate more people and better disperse visitors throughout Buffalo Pass area; would be handicap accessible	
	▸ A larger Granite Campground would help to lessen impacts to fragile ecosystems along Buffalo Pass from visitors in the area	
▸ Cumulative impacts from increased tourism due to summer marketing and from proposed Buffalo Pass capital investment project	▸ Cumulative impacts from increased tourism due to summer marketing and from proposed Buffalo Pass capital investment project	
	▸ Potable water supply would change campground from a free campground to a fee use campground	

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
TRANSPORTATION		
▸ Existing service roads would continue to degrade	▸ Service roads would be upgraded ▸ During mobilization and construction periods, average daily traffic along West Route would increase ▸ Probability of auto and/or bike accident would increase ▸ Increased probability of hazardous material or fuel spill during 2 seasons of construction ▸ Damage to roads and culverts would be likely and damage would need to be repaired by the permittee	▸ Impacts the same as Alternative B

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

TABLE 2-1
COMPARISON OF ENVIRONMENTAL IMPACTS

ALTERNATIVE A NO ACTION*	ALTERNATIVE B PROPOSED RESERVOIR EXPANSION	ALTERNATIVE C SMALLER RESERVOIR EXPANSION
VISUALS		
▸ Visual impacts would remain as they presently are; existing visual features (such as old borrow areas) would not be mitigated	▸ Larger dam structures visible ▸ Reservoir would not be completely drawn down; a long-term conservation pool would be maintained ▸ Maintenance of CWCB in-stream flow in lower Fish Creek ▸ Visual mitigation would be incorporated into the design, and where possible, visual aspects of the project (including structures, parking areas, roads, borrow areas, etc.) would be improved to meet the Visual Quality Objectives of the Forest Service ▸ Existing visual features (such as old borrow areas) would be mitigated	▸ Smaller dam structures than Alternative B visible ▸ Potential for complete reservoir drawdown in future; only short-term conservation pool ▸ No maintenance of CWCB in-stream flow in lower Fish Creek ▸ Visual mitigation same as Alternative B
CULTURAL RESOURCES		
▸ No significant impacts	▸ No significant impacts	▸ No significant impacts

* The Forest Service could modify the existing Fish Creek Reservoir Special Use Permit and/or the existing operating plan to address certain environmental consequences of the No Action Alternative. At this point in time, mitigation requirements under the No Action Alternative have not been formally defined by the Forest Service. In the event that the No Action Alternative is selected by the Forest Supervisor, the nature and extent of potential mitigation would be further defined by the Forest Service.

2.6 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The Forest Service preferred alternative is Alternative B.

2.7 PROJECT ALTERNATIVES AVAILABLE TO THE PROPONENT

Several project alternatives are potentially available to the Proponent including:

- Water Conservation
- Infiltration Gallery Expansion

The Proponent may or may not elect to expand the Fish Creek Reservoir, depending on the Forest Service final decision on the EIS and other relevant factors. Water conservation and infiltration gallery expansion were identified during the scoping process as alternatives to reservoir expansion. These alternatives, however, cannot be selected by the Forest Service because the Forest Service has no authority to require the Proponent to impose conservation practices on the residents of the City of Steamboat Springs or require the City or Mt. Werner to expend tax dollars for expansion of the infiltration galleries. However, selection of the No Action Alternative by the Forest Service would most likely cause the Proponent to consider these two alternatives to provide for the future water needs of the area. The alternatives are discussed in the following sections because of public interest and comments from cooperating agencies, and in fulfilling the intent of NEPA and its disclosure requirements.

2.7.1 Water Conservation

2.7.1.1 Introduction

Water conservation is briefly discussed in this section. A more comprehensive review of water conservation methods is presented in Appendix C, *Water Conservation.*

2.7.1.2 Background

In arid regions, such as the western United States, water has become an increasingly scarce natural resource. Due to rapid growth and development, demand for water has steadily risen and has surpassed available supplies in some areas. Water resource management has traditionally been applied to the construction of treatment facilities and the development of water supply projects such as dams and reservoirs. However, because water resources have become scarce in many regions of the country, it has become necessary for water resource managers to develop water conservation programs.

According to the United States Water Resources Council, water conservation is defined as activities designed to; 1) reduce the demand for water, 2) improve efficiency in use and reduce losses and waste of water, or 3) improve land management practices to conserve water (Maddaus, 1987). Through the installation of appropriate low flow water fixtures and by educating the public about techniques designed to reduce water use, water efficiency can be increased.

Water conservation programs can result in significant benefits to the water utility and its customers. In general, conservation measures can reduce demand or increase supply during drought years, or can extend short supplies during other emergency conditions. Water conservation can also result in:

- Energy savings
- Wastewater reductions
- Cost reductions
- Environmental protection

Reductions in water use can decrease the amount of energy used to heat water in our homes and offices. Water heaters are the second largest energy users in the home, and heating water consumes the equivalent of 1.1 million barrels of oil per day nationwide. One third of our hot-water use can be reduced, however, by effective water conservation (Maddaus, 1987).

Water conservation is also a means by which costs associated with water and wastewater treatment can be lowered. Conserving water can decrease water demand and wastewater flow and thus save pumping energy and reduce chemical use involved in water and wastewater operations. Large water savings can also prevent the need to expand or build additional treatment facilities.

Furthermore, as a means of protecting the environment, water use reductions can result in increased stream flows and water levels in existing reservoirs, and reduced drawdowns of underground aquifers.

Potential drawbacks that should be considered, however, prior to implementing a water conservation program include:

- Reduction of water utility revenues
- Delay in construction of water supplies
- Increase in drought vulnerability
- Growth impacts

The implementation of water conservation practices can result in lower water bills, and consequently, reduced revenue for the water utility. As previously discussed, however, water conservation can also result in decreased capital, operation, and maintenance expenditure. Water utility master planning is required, therefore, to accurately define projected utility expenditures such that appropriate rate structures can be instituted.

Due to demand reductions associated with water conservation programs, construction of additional water supply facilities could be postponed. Delaying construction of new water supplies, however, could result in higher construction costs.

Furthermore, delaying the augmentation of a water utility's supply capacity can increase a community's vulnerability to drought and thus create more hardship during shortages. It is difficult for communities that already maximize conservation, and are without a surplus of water, to further reduce water use during times of drought.

Conservation could also result in growth impacts within a community. Water conservation can be perceived as creating additional sources of water which can be used to extend service to undeveloped areas. On the other hand, a lack of water can result in cost of living increases and potentially

restrict growth in severe situations. In regions where community growth is controversial, these issues should be evaluated (Maddaus, 1987).

2.7.1.3 Methods of Water Conservation

There are a number of water conservation methods which would be available to the Proponent. A list of commonly used water conservation practices is presented in Table 2-2, Typical Long-Term Water Conservation Measures. A detailed discussion on various water conservation methods and the demand reductions that typically result from the implementation of these methods appears in Appendix C, *Water Conservation*. Table 2-3, Typical Demand Reductions, presents a summary list of the demand reductions that are reported in Appendix C. It is important to note that the ultimate results of implementing a formal water conservation program in the City and Mt. Werner would rely on many site-specific factors and would depend largely on the cooperation of the community, itself. The City and Mt. Werner are presently pursuing several water conservation measures, as discussed in detail in Section 3.3.9.

2.7.1.4 Impacts of Conservation

Under the conservation alternative, water demands could be reduced by approximately 10 to 30 percent. This represents a water savings of approximately 260 to 780 AF/year today and 620 to 1,850 AF/year in the year 2010, assuming that the high growth scenario occurs (see Section 3.4).

Cumulative impacts associated with the reduction in water demand would include the cost savings associated with the decrease in water and wastewater treatment volumes. Water and wastewater treatment operation and maintenance costs would be reduced and costly treatment plant expansions could be avoided. Additionally, infrastructure capital and operation costs associated with the distribution of water and collection of wastewater could be reduced.

With a metered billing rate, however, conservation could also result in decreased water and wastewater utility revenues. Furthermore, it could take several years before the effects of conservation are realized and facility expansion could still be required.

Additionally, the utilization of water conservation techniques, such as xeriscaping, could alter the visual nature of the landscape.

2.7.2 Infiltration Gallery Expansion

Another alternative available to the City and Mt. Werner is the Infiltration Gallery Expansion. The City and Mt. Werner have both constructed infiltration galleries (also known as well fields) to augment the water supplied from the Fish Creek basin. Water quality concerns associated with the utilization of the infiltration galleries are discussed in Section 3.3.4.2.

The Forest Service, City, and Mt. Werner have eliminated the Infiltration Gallery Expansion from further consideration at this point in time for several reasons including poor water quality, potential net depletions to the Yampa River, the need to construct additional water treatment and distribution facilities, and the continued pumping costs associated with utilization of the infiltration galleries. Concerns associated with the infiltration galleries are detailed in Section 3.3.4.2 of this EIS and in the City's *Infiltration Gallery Analysis* included as Appendix D.

TABLE 2-2 TYPICAL LONG-TERM WATER CONSERVATION MEASURES	
General	Public information In-school education Metering Pressure reduction Pricing Uniform commodity rates Inclining commodity rates Seasonal rates Leak detection and repair System rehabilitation Water Use Restrictions
Interior residential use	Low-flow shower heads Shower-flow restrictors Toilet–tank displacement bottles/dams Pipe insulation Faucet aerators Water-efficient appliances
Devices for new construction	Low-flush toilets and ultra-low-flow toilets Low-flow shower heads Pipe insulation Faucet aerators Water-efficient appliances
Power generation	*Recirculation of cooling water Reuse of treated wastewater *In-system treatment
Industrial use	*Recirculation of cooling water *Reuse of cooling and process water Reuse of treated waste water Efficient Landscape irrigation Low-Water-using fixtures *Process modification
Agricultural irrigation	Off-farm conveyance systems *Canal lining, canal realignment, canal consolidation *Phreatophyte control On-farm distribution and irrigation systems *Ditch lining or piping *Water-control structures *Land leveling or contouring Sprinkler irrigation Drip irrigation Subsurface irrigation *Tailwater irrigation Irrigation scheduling *Improved tillage practices Surface mulches Pressure regulator
Landscape irrigation	Efficient landscape design Low-water-use plant material Scheduled irrigation Efficient irrigation systems Tensiometers
*These conservation practices are not discussed in detail in this report.	

TABLE 2-3
TYPICAL DEMAND REDUCTIONS

Conservation Practices	Typical Reductions
Inclining Block Rates	10% of Residential Water Use
Peak/Seasonal Demand Pricing	6-83% of Peak Demand 3-10% of Total Demand
Pressure Reducing Valves (PRVs)	10% of Total Supply
General Outdoor Conservation	40-54% of Outdoor Use
Ultra Low Flow Toilets	57-78% of "Toilet Demand"
Low Flow Showerheads	34-50% of "Shower Demand"
Faucet Aerators	Up to 48% of "Faucet Demand"
Retrofit Kits sent to homes (toilet tank bag, leak detector, dye tablets, shower flow restrictors, rain gauges)	Up to 6% of Indoor Use
Public Education	8% of Total Water Use

CHAPTER 3

AFFECTED ENVIRONMENT

CHAPTER 3 - AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter identifies and describes the existing environmental conditions and resources which may be affected by the proposed action or alternatives. Preparation of the resource descriptions has been guided by applicable NEPA provisions presented in 40CFR Part 1502.15, which direct that the environmental document:

> *"... succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration..."*

Information presented in this chapter is taken from the baseline technical reports which contain detailed technical analyses and serve as back-up documentation to this EIS. The following resource areas are presented in the baseline technical reports and are summarized in this chapter:

- Dam Safety/Flood Hazard
- Water Resources (Water Rights, Quality, Demand, etc.)
- Socioeconomics
- Wetlands
- Vegetation
- Wildlife
- Recreation
- Transportation
- Visual Resources
- Cultural Resources

The reader wanting further detail than that presented in this chapter for these resource areas is referred to the baseline technical reports.

3.2 DAM SAFETY/FLOOD HAZARD

3.2.1 Introduction

A survey of the current conditions of the existing dam, dam operations, safety features, and flood hazard conditions at Fish Creek Reservoir, as well as a study of the geology, seismicity of the project area, were performed. The results of this survey appear in the *"Dam Safety/Flood Hazard Baseline Technical Report for the Fish Creek Reservoir EIS"* (ACZ, 1992a). Included in the following section is a discussion of existing dam structures, and of potential flood hazards associated with the current conditions at Fish Creek Reservoir. Geologic conditions associated with flood hazards which were identified in the aforementioned report are also discussed.

3.2.2 Existing Dam and Ancillary Structures

3.2.2.1 Current Conditions

The existing Fish Creek Reservoir is formed by two earthfill embankments, composed of a main dam and saddle dam as shown on Figure 3-1. The main dam is a homogeneous, earthfill structure with chimney and blanket drains (WCC, 1991a). The maximum height of the main dam is 55 feet,

with a centerline length of 650 feet and a crest width of approximately 25 feet. The downstream and upstream slopes are 2:1 and 3:1, respectively (horizontal to vertical). The current outlet works are composed of a 24-inch diameter welded steel pipe, with an upstream control gate.

The saddle dam, located approximately 2,200 feet northeast of the main dam, is a zoned, earthfill embankment with a central core, blanket drainage zone, and upstream and downstream shells. This structure has a maximum height of approximately 16 feet and a crest length of 400 feet. The downstream and upstream slopes are 2.5:1 and 2.75:1, respectively.

3.2.2.2 Construction History

The original Fish Creek embankment was constructed in 1954-1955, as a modified homogeneous dam with the spillway located where the saddle dam is presently situated. The majority of the fill consisted of silty sand and gravel with a low percentage of cobbles. It is assumed this material was derived from the glacial sediments which are prevalent throughout the project area. The downstream toe of the embankment consisted of a relatively thick blanket drain connected to a vertical chimney drain.

The main dam was raised four feet in the late 1950's. However, detailed records of how this enlargement was completed are unavailable.

In 1973, the main dam was enlarged by placing random fill on the downstream portion of the original embankment. According to Chen (1982), the random fill consisted of slightly to very silty sand and gravel with a small to medium amount of cobbles. The drainage blanket was designed to extend beneath the toe of the enlarged section (Chen, 1982). However, field investigations conducted by Chen (1982), found no evidence the drainage was completed during construction. The outlet pipe, however, was extended downstream during 1973 construction and enlargement.

The saddle dam was also constructed in 1973, during the enlargement of the main dam and as a means to block the original spillway and provide greater storage capacity. A toe drain was not constructed as part of the saddle dam.

3.2.3 Dam Operations

Water levels are maintained and controlled in the reservoir by a 24-inch diameter welded steel outlet pipe. A gate at the inlet is controlled with a steel stem along the upstream face connected to a mechanical operator at the crest of the dam. The outlet structure intake gate does not seal well and prevents the complete shutoff of flow through the outlet (WCC, 1992a).

The existing spillway is an open-cut structure in bedrock located at the right abutment of the saddle dam (see Figure 3-1). The spillway discharges water into a small natural lake, Puppy Dog Lake, which flows into an intermittent drainage that joins Fish Creek, downstream of the main dam.

Currently, Fish Creek Reservoir has no remotely operated or automated systems to control water discharge.

Project No.: 828-1500	Design By: T. LEIDICH	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC3EXIST.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-1			EXISTING FISH CREEK RESERVOIR MAIN DAM & SADDLE DAM

3.2.4 Safety Features

In the unlikely event that either the main or saddle dam failed, it is estimated that floodwaters believed to be worse than the 500-year flood event, would reach Steamboat Springs in less than 30 minutes (CSM EPICS, 1990). Lives and property would be at risk. Currently, the Fish Creek dams contain no early warning system to alert the public to a flood hazard.

As part of the Colorado Dam Safety Program, the State has prepared a *Dam Safety Manual* (January 1988), that presents guidance and establishes compliance requirements for dam owners to maintain safe structures, avoid costly repairs, and prolong the life of the dam. The *Dam Safety Manual* classifies structures on the basis of hazards to human life. Accordingly, the Fish Creek Dam and saddle dams are designated as "Class A, High Hazard" dams since failure would cause extensive property damage and would possibly cause the loss of life (CSM EPICS, 1990). Based on the high hazard classification, the Colorado Dam Safety Manual recommends the following inspection/operation program:

- Daily - Surveillance by the owner or caretaker
- Weekly - Monitoring of seepage
- Monthly - Thorough visual inspections. Gathering, immediately plotting and interpreting observation well and piezometer data
- Annually - reading horizontal and vertical control monuments (more frequently if necessary)
- Test operation of outlet and spillway mechanical components
- Routine maintenance as required

Since their construction, the Fish Creek dams have received periodic inspections by personnel from the State Engineer's office and the City. Daily and weekly inspections are not feasible during winter and spring months. However, flood impacts are also highly reduced during this period, due to low flow conditions in Fish Creek. In 1980, an inspection was performed by Charles T. Main, Inc. under the National Dam Safety Program. Recently, the State of Colorado, Division of Water Resources - Dam Safety Branch has completed dam safety inspections on the Fish Creek embankment. According to inspection records, the most recent inspection occurred on October 7, 1992, with previous inspections approximately 14 months prior to this date. During the October 1992 inspection, the Fish Creek Dam and outlet structure was reported in satisfactory condition with minor seepage recorded along the left abutment and evidence of minor slump/slide features on the downstream slope.

As part of the Emergency Preparedness Program, outlined by the Colorado Office of Dam Safety, the City has completed an *Emergency Preparedness Plan* (July 1992). This plan includes details on the dam operation and storage capacities, a list of persons downstream first affected by floodwaters, and an emergency plan which identifies responsible public officials in the case of an emergency. A copy of this plan appears in Appendix E.

3.2.5 Geologic Conditions

3.2.5.1 General

The project area lies in northwest Colorado, near the Continental Divide. Situated on the west flank of the Park Range, the Fish Creek Reservoir is underlain by Precambrian granitic and metamorphic rocks which have been upthrown along north-south and northeast-southwest trending normal faults. The reservoir is located immediately northwest of the gently sloping crest of the Continental Divide.

The general landform associated with the project area is characterized as stable, rugged mountain terrain with numerous rock outcrops. West and northwest of the reservoir site, the terrain steepens significantly, due to deep erosion caused by Fish Creek.

The regional geology of the project area includes granitic, metamorphic and unconsolidated surficial deposits and rock of Quaternary age. Granitic rock outcrops are mapped (Tweto, 1979) in and near the reservoir site and include granites, quartz monzonites or granodiorites, approximately 1,700 million years in age. Metamorphic rock outcrops have been mapped (Chen, 1982) in the immediate vicinity of the reservoir area and designated borrow sources. Metamorphic rock typically contains minor hornblende, gneiss, calc-silicate rock, quartzite and marble. Much of the project area is covered by unconsolidated surficial deposits and rock of Quaternary age believed to be associated with Pinedale and Bull Lake Glaciation episodes.

The surficial geology of the reservoir area has been mapped by several authors (Chen, 1982; WCC, 1991; Madole, 1991a).

3.2.5.2 Bedrock Geology

Bedrock outcrops composed of metamorphic and locally igneous intrusive rock exist within the footprint of the reservoir and throughout the general vicinity of the project site. These rocks are generally considered quite strong and moderately fractured. Weathering of the rock surface varies from fresh to moderate. The more resistant igneous rocks are generally strong and only slightly weathered while the metamorphic rock (gneiss and schist) exhibit greater degrees of weathering.

Chen (1982) has mapped three principal joint sets which are present along the 1) left abutment of the main dam, 2) right abutment of the main dam, and 3) along the saddle dam. Joints generally represent fractures in the rock mass which are vertical or transverse to the bedding direction and along which no appreciable movement has occurred.

Several northeast-southwest trending faults have been mapped in the immediate vicinity of the project (Tweto, 1979). The seismic impact associated with these faults is discussed in detail in Section 3.2.6.

3.2.5.3 Surficial Geology

The *Surficial Geologic Map of the Steamboat Springs Area* (Madole, 1991a) has identified two principal surficial material types. The main dam area and immediately west of the centerline of the main dam has been mapped as residuum on Precambrian crystalline rock. This material is composed of sand, silt, some clay, and angular to subrounded clasts that are chiefly schist, gneiss, amphibolite and granitic rock. East of the main dam embankment and composing the reservoir, the area has been mapped as glacial deposits composed of boulders, cobbles, and pebbles in a sandy matrix. This unit

is believed to be 1-5 meters thick in most places, with a maximum thickness of approximately 30 meters.

According to Chen (1982), the soil deposits in the vicinity of the project site are predominantly of glacial origin. Most of the soils are glacial till (Pinedale and Bull Lake Glaciation episodes) and are composed of poorly sorted gravel, cobbles and boulders in a sandy silt matrix. A thin veneer of alluvial soils are present along the floodplain of Granite Creek, the Middle Fork of Fish Creek, and several unnamed creeks flowing into the reservoir area. The alluvial soils are generally well sorted, and the matrix has a lower percentage of fines (fine sand, silt and clay) than the glacial deposits. In addition, Chen (1982) encountered alluvial soils in pits excavated downstream of the saddle dam structure near the northern edge of Puppy Dog Lake, in the drainage below the proposed spillway and upslope of an old borrow area on the southeast side of the reservoir.

3.2.6 Geologic Hazards

Geologic hazards associated with the Fish Creek Dam may include seismic hazards, geotechnical/foundation failure impacts, and mass movement. Brief descriptions of each impact are presented below.

3.2.6.1 Seismic Hazards

Seismic hazards impacting the project site may be manifested as surface faulting and strong ground-shaking, related to earthquake activity in the surrounding region. Associated ground disturbance such as differential settlements and liquefaction may occur, depending on the type of soil conditions prevalent at the site and the magnitude of the seismic event. The probability of having an earthquake in some regions is greater than others and is generally a function of the seismic activity in a particular region and their intensity. Ground shaking associated with a seismic event near a particular embankment may impact foundation conditions. For example, foundations consisting of low relative density sands and silts or uniform fine-grained, cohesionless materials, may result in the development of high pore pressures resulting in liquefaction conditions. Similarly, ground vibrations caused by earthquakes often lead to compaction of cohesionless soil deposits and associated settlement of the ground surface.

In the Central Rocky Mountains of northern Colorado, seismicity appears to be primarily associated with the faulted Laramide age mountain uplifts (Algermissen et al, 1982). Fish Creek is situated in the Northern Rio Grande Rift subprovince of the Central Rocky Mountain region. This subprovince includes Neogene (approximately the past 25 million years) age faults, historical earthquakes and major structural and physiographic regions. Active fault activity is defined by the age of material displaced by fault movement. According the Colorado Geologic Survey (Kirkham and Rogers, 1981) potentially active faults are defined as faults that have experienced movement during the Neogene period. This categorization is not intended to imply that all potentially active faults are hazardous, but rather that these faults should be considered in the design of a critical structure. Kirkham and Rogers' (1981) potentially active fault classification exceeds other acceptable definitions of seismic capability.

Other regulating agencies, including the U.S. Nuclear Regulatory Commission (NRC), have identified active faults as those faults that have displaced Holocene (10,000-12,000 years) age material. Typically, active fault activity is in the form of well developed, non-degraded topographic scarps, that suggest geologically recent (early Pleistocene to Holocene) development, or in the form of stratigraphic displacement of Quaternary sediments that demonstrate relatively young movement.

For the Fish Creek Dam evaluation, active faulting is assumed to be associated with seismic events that have displaced Holocene or younger age material.

The Colorado Geological Survey has mapped the Steamboat Springs Fault and an associated group of east-dipping faults as the nearest potentially active faults. The Steamboat Springs Fault is thought to have about 300 meters of vertical movement since deposition of the Miocene-Pliocene Browns Park Formation. There has been no mapped or inferred data which suggests Quaternary or Holocene movement has occurred on the Steamboat Springs Fault. Based on magnitude versus fault length relationships presented by Slemmons (1977), and assuming the Steamboat Springs fault experienced movement, a maximum credible earthquake (MCE) with a magnitude of 6.6 could be generated. This magnitude earthquake corresponds with the Colorado Geological Survey estimate of maximum credible earthquakes for the Northern Rio Grande seismotectonic subprovince.

A review of recent high altitude infrared aerial photography (1"=2,000′) identifies several prominent lineaments which are situated in the immediate vicinity or adjacent to the project boundaries. Each photograph was analyzed for the presence of linear features (lineaments) which may represent recent fault activity. In general, lineaments were manifested as linear drainages, rock contacts, landforms, vegetation alignments, and optical density (tone) changes. In addition to a lineament analysis, each image was examined for evidence of: 1) folded structures, the axes of which were determined by observation of strike and dip; and 2) major rock type, which is differentiated on the basis of color, tone, drainage density, drainage pattern, geomorphic expression and land use.

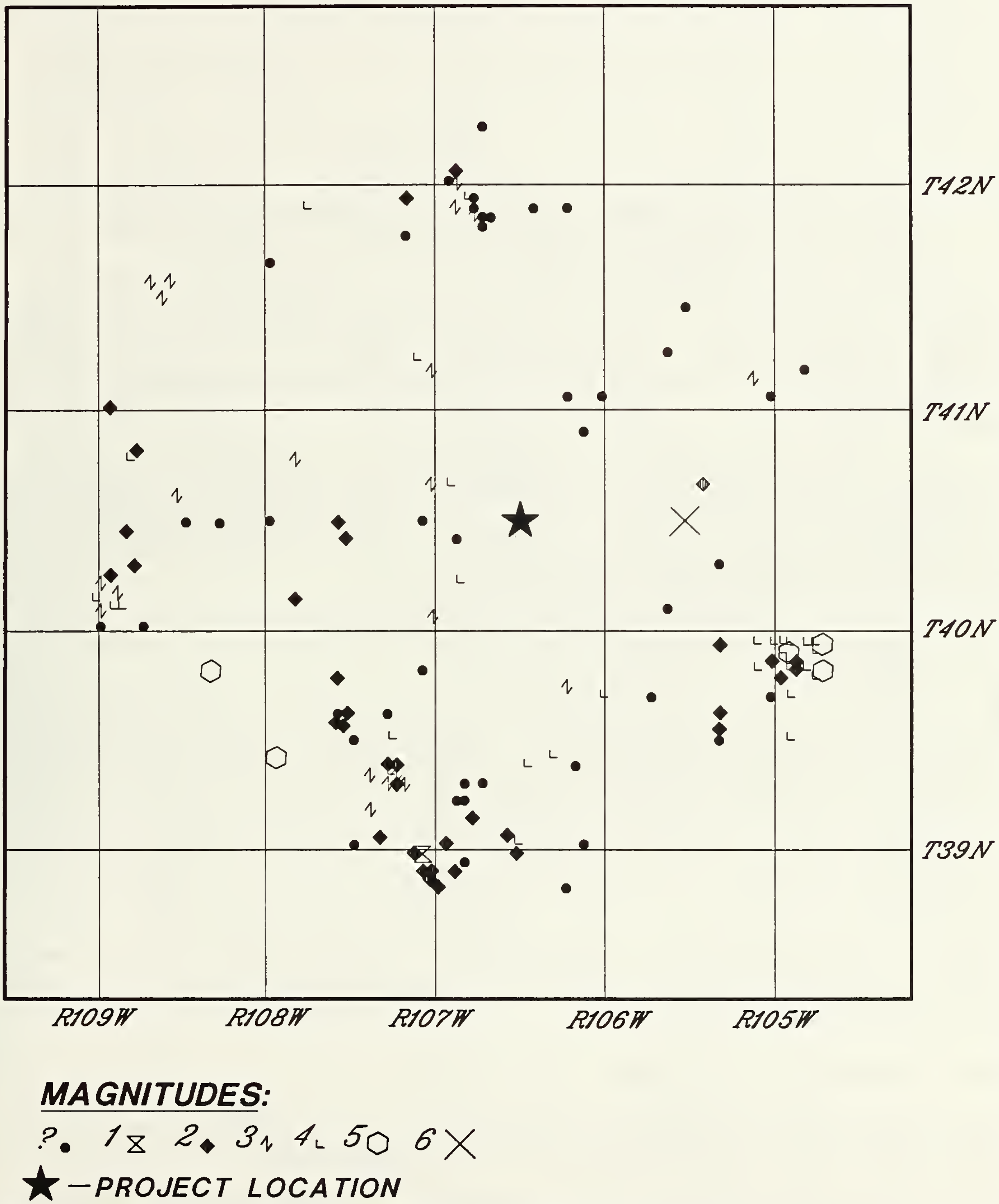
The bedrock structural geology, as defined in Section 3.2.5.2 includes three predominant conjugate joint sets (Chen, 1982). Based on the orientation of these structural features, they may represent lineaments which were detected during the lineament analysis for the project. The primary orientation of the lineaments detected during the analysis trend northeast-southwest. This orientation generally coincides with one of the three primary joint sets mapped previously by Chen (1982), at the site.

The nearest lineament to the reservoir area trends northeast-southwest and is located approximately 1.3 miles from the project site. This lineament is shown on the Geologic Map of Colorado (Tweto, 1979), and was identified during the photogeologic lineament analysis. Based on a review of all existing information, including infrared aerial photography, there is no evidence which indicates recent (Holocene) activity along this lineament.

Based on a review of the U.S. Geological Survey (USGS), National Earthquake Information Center earthquake data, earthquakes recorded from 1871 to 1991 at a radius of 200 km (124 miles) from Steamboat Springs, Colorado were plotted. A plot of the earthquake epicenters is presented on Figure 3-2. The selection of a 200 km radius for earthquake data is subjective. However, earthquake attenuation curves, generated for both bedrock and soil conditions (Seed and Idriss, 1982), indicate significant attenuation of earthquake energy from the zone of energy release. Beyond a 200 km radius from the site for any given earthquake event the peak horizontal bedrock acceleration is substantially dampened.

Since 1871, the Steamboat Springs area has experienced over 378 earthquakes within a 200 km radius. Earthquakes occurring outside of the 200 km radius are not expected to have any damaging effects on the reservoir. The majority of the earthquakes occurring within the 200 km radius zone have been small, ranging in magnitude from 2 to 5 on the Richter Scale. There have been 57 seismic events registering magnitudes greater than 3.5 (see Table 3-1, Earthquake Summary, 1871 to 1991).

U.S. Geological Survey, National Earthquake Information Center
Data taken from the Earthquake Data Base System



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File: FC3EPIC.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-2			EARTHQUAKE EPICENTERS 1871 - 1991

TABLE 3-1 EARTHQUAKE SUMMARY 1871 - 1991	
RANGE OF MAGNITUDES	NUMBER OF EVENTS
1-2	12
2-3	183
3-4	45
4-5	44
5-6	5
>6	1
Include body-wave magnitude (mb) or average National Earthquake Information Service (NEIS) magnitude as well as contributed magnitudes. In the event both mb and contributing magnitude values were recorded the higher value was used.	

The closest measured earthquake event to the Fish Creek project site was recorded approximately 26 kilometers from the project site and had a magnitude (mb) of 4.4. According to a review of available seismic and geologic literature, no surface disturbance of active faulting occurred at the site as a result of this event.

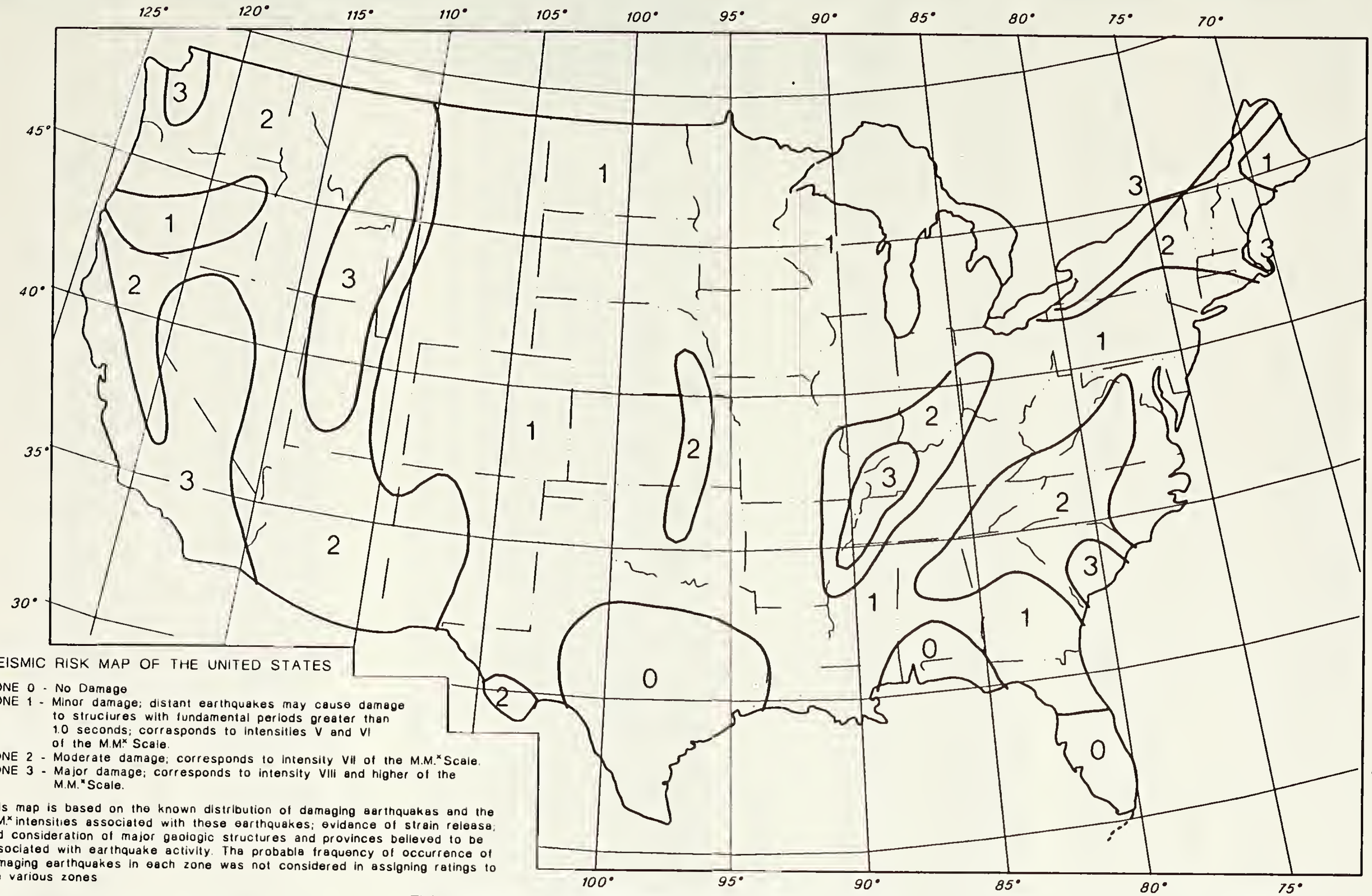
According to the *Seismic Risk Map of the United States* (Algermissen, 1969), the site lies within Zone 1 (See Figure 3-3, Seismic Risk Map of the United States). Zone 1 is described as: "Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds; corresponds to intensities V and VI of the Modified Mercalli Intensity Scale". An excerpt from the abridged definition of an intensity VI is as follows:

> *"Felt by all; many are frightened and run outdoors; falling plaster and chimneys; damage small."*

Woodward-Clyde (1992a&b) has developed bedrock accelerations, based on seismic and geologic data, appropriate for the design of the proposed dam. Historical evidence suggests that the peak ground acceleration at the site has not exceeded 0.05g during the last 100 years (WCC, 1991). As a result, a conservative estimate of 0.1g or twice the probable historical maximum was chosen in the design as the operating basis acceleration. For the maximum design earthquake (MDE), the design has included a more conservative analysis. This analysis assumed the Steamboat Springs fault was the controlling structure and generated a 6.6 magnitude earthquake (WCC, 1992b). Using this magnitude estimate and distance between potential fault rupture and the Fish Creek site, accelerations were determined from existing attenuation relationships. Based on these attenuation relationships, the maximum design acceleration, which corresponds to a MDE of 6.6 on the Steamboat Springs fault, is 0.24g.

3.2.6.2 Geotechnical/Foundation Hazards

Non-earthquake related geotechnical/foundation conditions including differential settlement and seepage/piping through foundation material are possible geologic hazards.



SEISMIC RISK MAP OF THE UNITED STATES

ZONE 0 - No Damage
ZONE 1 - Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds; corresponds to intensities V and VI of the M.M.* Scale.
ZONE 2 - Moderate damage; corresponds to intensity VII of the M.M.* Scale.
ZONE 3 - Major damage; corresponds to intensity VIII and higher of the M.M.* Scale.

This map is based on the known distribution of damaging earthquakes and the M.M.* intensities associated with these earthquakes; evidence of strain release; and consideration of major geologic structures and provinces believed to be associated with earthquake activity. The probable frequency of occurrence of damaging earthquakes in each zone was not considered in assigning ratings to the various zones

* Modified Mercalli Intensity Scale of 1931.

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FIGURE 3-3

FISH CREEK RESERVOIR EIS

SEISMIC RISK MAP OF THE UNITED STATES

According to Woodward-Clyde (1992b), the main dam embankment is founded on glacially deposited soils except for the cutoff trench extending to bedrock. These subsoils are generally 10 to 20 feet thick, and consist of dense to very dense, slightly to very silty sands and gravels with a medium to large quantity of cobbles and boulders. The soil deposits thicken to about 35 feet on the right abutment. The increase in depth to bedrock at the right abutment is believed to be due to an ancient valley fill channel.

The saddle dam embankment is also reportedly situated on glacially deposited subsoils (WCC, 1991). These subsoils extended about 8 feet below the cutoff trench near the center of the dam.

Seepage in both the main and saddle dams were recorded by Chen (1982), during geotechnical investigations associated with proposed plans to expand the storage capacity of the reservoir.

Seepage occurred about midway down the left (south) abutment of the main dam at its contact with the foundation rock. Seepage downstream of the saddle dam was evidenced by standing water and marshy ground and vegetation. Seepage in the main dam is located along the left abutment and may be attributed to fracture flow in the bedrock unit.

Settlements and or slumping has been minimal according to dam safety records. Minor slumping conditions were observed on the upstream main dam embankment during an August 1991 dam safety inspection.

3.2.6.3 Mass Movement

Mass movements including landsliding, mass wasting, and avalanches generally exist in areas where slope conditions exceed 30 percent. The main dam and saddle dam are situated in relatively flat (<20 percent) slopes and, therefore pose little risk to mass movements. Portions of the Fish Creek drainage exceed 30 percent slopes, and thus may include mass wasting impacts. Mass movement typically occurs during abnormally wet periods, particularly in the spring. Rockfall is defined as the rapid downward movement of rock fragments by free-falling, rolling, bounding, or sliding in response to the force of gravity. Freeze-thaw action is the major process involved in fracturing rock outcrops and producing rock fragments. Rockfall originates from cliffs of massive, fractured or jointed bedrock and from steep ledges undercut by natural erosion processes or by human activity. Rockfall hazards within the project area are limited to the steep portions of the Fish Creek drainage where the incision of the creek has formed steep bedrock sidewalls.

3.2.7 Flood Hazard

Two recent flood hazard evaluations have been completed for the Fish Creek Dam which predict downstream effects associated with embankment failure. The Colorado School of Mines completed a flood hazard study in 1990 (CSM EPICS) which has been subsequently superseded with a more recent dambreak analysis performed by Woodward-Clyde in 1992 (WCC, 1992c).

The CSM EPICS flood hazard study classifies the Fish Creek Dam as a "Class A, High Hazard" structure. According to the EPICS (1990) study, a flood resulting from the failure of the Fish Creek Dam as it now exists, would result in the loss of approximately 200 homes, several dozen businesses, one of the area's major shopping centers, a retirement home, and 4-5 bridges which would be either lost or seriously damaged.

Woodward-Clyde (1992c), has completed an independent dambreak analysis to assist in the design of an early warning system to evacuate the floodplain areas which would be inundated in case of a dam failure. The dambreak analysis consisted of a breach analysis for the existing dam at normal water elevation of 9,866, (Alternative A) dam raise at normal water elevation of 9,875 (Alternative C) and the proposed dam raise at a normal water elevation of 9,886 (Alternative B). It should be noted that this analysis assumes normal conditions prior to the dam breach which Woodward-Clyde (1992c) considers to be the most likely scenario. If the dam breached during an already existing flood, the water levels would be significantly higher and likely exceeding the 500-year flood levels.

While property damage associated with failure during a flood and/or high precipitation condition is expected to approach that predicted under a 500-year flood (CSM EPICS, 1990), the potential of loss of life is believed to be less because residents living in the flood plain are aware of an on-coming flood due to rainfall conditions (WCC, 1992c).

Woodward-Clyde (1992c), estimates a flood wave 17 feet deep and a peak discharge of 41,000 cfs would reach the water treatment plant in 1.1 hours if there was a failure of the existing main dam at normal water levels. An estimated flood wave 11 feet deep and a peak discharge of 26,200 cfs would reach the downtown area of Steamboat Springs in 1.7 hours if there was a failure of the existing main dam at normal water levels. Projected flood inundation is shown in Figure 3-4. A copy of Woodward-Clyde's dambreak analysis is presented as Appendix F.

3.3 WATER RESOURCES

3.3.1 Introduction

This section discusses the water resources which may be affected by the Proposed Action and/or the alternatives to the Proposed Action. It contains information pertaining to water supply, project hydrology, water rights, water quality, the existing water system and facilities, water demand, water storage requirements, and water conservation measures presently employed by the City and Mt. Werner. Descriptions of these elements concentrate on the proposed Fish Creek Reservoir expansion area, the Fish Creek drainage basin, and the water service area including Mt. Werner and the City. Further details on water resources are found in the *Water Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992b).

3.3.2 Water Supply

3.3.2.1 Regional Hydrology and Climatology

Fish Creek Reservoir is located approximately 7 miles east of the City of Steamboat Springs, Colorado. The Fish Creek drainage area is tributary to the Yampa River. The Yampa River originates in the headwaters of tributary streams south of the town of Yampa and flows in a northerly direction through Steamboat Springs. It then flows in a westerly direction to the Colorado-Utah border where it joins the Green River. The Green River flows south through eastern Utah to its confluence with the Colorado River southwest of Moab, Utah.

Temperature and precipitation data have been collected in Steamboat Springs since 1908. The average annual temperature for the period 1908 through 1990, is 38.7 degrees Fahrenheit (F). The average daily maximum temperature is 55.5 degrees F, and the average daily minimum temperature is 21.8 degrees F. The average total precipitation for the same period of record is 23.86 inches (SCS, 1992). Most of the annual precipitation falls as snow. The accumulated snowpack in the area

supplies the majority of the stream runoff. Climatic conditions in the City of Steamboat Springs, and the surrounding mountain areas, can be substantially different. Average annual temperature at Buffalo Pass (Tower Gage) is 31.23 degrees F for 1987 through 1991. The average daily maximum temperature is 44 degrees F and the average daily minimum temperature is 15 degrees F. The average total precipitation at the Tower Gage is 57.47 inches for 1980 through 1991 (SCS, 1992). Snotel and snow course data is also available at the Tower Gage and is discussed in Section 3.3.2.3.

3.3.2.2 Project Hydrology

The Fish Creek drainage area is located near the Continental Divide, east of the City of Steamboat Springs, in the Routt National Forest. The watershed boundary in the headwaters of this drainage, forms the county line between Routt County to the west of the Continental Divide, and Jackson County to the east of the Continental Divide. North Fork, Middle Fork, and South Fork are the main tributaries to Fish Creek. The watershed has an area of approximately 28 square miles from the headwaters at the divide to its confluence with the Yampa River. The Fish Creek Reservoir is located on the Middle Fork. Figure 3-5 shows the location of the Fish Creek drainage basin. Figure 3-6 shows stream miles from the mouth of Fish Creek on the Yampa River to the headwaters of each tributary.

The North Fork of Fish Creek originates at the Continental Divide, north of Buffalo Pass at an elevation of 10,724 feet. Buffalo Pass and the Soil Conservation Service (SCS) Tower Gage snow survey site are located along the Buffalo Pass Road at an elevation of approximately 10,300 feet. The North Fork flows in a southwest direction to the confluence with the Middle Fork at elevation 8,320 feet. The drainage area above the confluence with the Middle Fork, is about 10 square miles. The North Fork continues in a southwesterly direction to the confluence with the South Fork just below Fish Creek Falls, elevation 7,520 feet. Channel slope for the North Fork of Fish Creek is approximately 0.09 feet/foot. The total drainage area for the North Fork of Fish Creek, including the Middle Fork, is 17.5 square miles.

The Middle Fork of Fish Creek originates at the Continental Divide at an elevation of 10,566 feet. The Middle Fork flows in a westerly direction to its confluence with the North Fork of Fish Creek. The drainage area of the Middle Fork above the confluence with the North Fork of Fish Creek, is 7.59 square miles at elevation 8,320 feet. The channel slope of the Middle Fork of Fish Creek is approximately 0.09 feet/foot. Fish Creek Reservoir, as discussed in Section 3.2.2, is located on the Middle Fork of Fish Creek and is fed by the Upper Middle Fork of Fish Creek from the northeast and Granite Creek from the southeast.

The drainage area of the Upper Middle Fork is 1.56 square miles with an elevation range from 10,566 feet to 9,866 feet, the normal water level elevation in Fish Creek Reservoir. Granite Creek has a drainage area of 3.2 square miles with an elevation range from 10,440 feet to 9,866 feet (normal reservoir water level elevation). The drainage area above the dam on the Middle Fork of Fish Creek, including the area of Fish Creek Reservoir, is 5 square miles. The spillway drains to the Puppy Dog Lake drainage, which has an area of 0.8 square miles and an elevation range from 10,398 feet to 9,440 feet. The channel slope of the Puppy Dog Lake drainage from the spillway to the confluence with the Middle Fork is approximately 0.12 feet/foot. The Middle Fork of Fish Creek joins the North Fork approximately two miles downstream of the main dam.

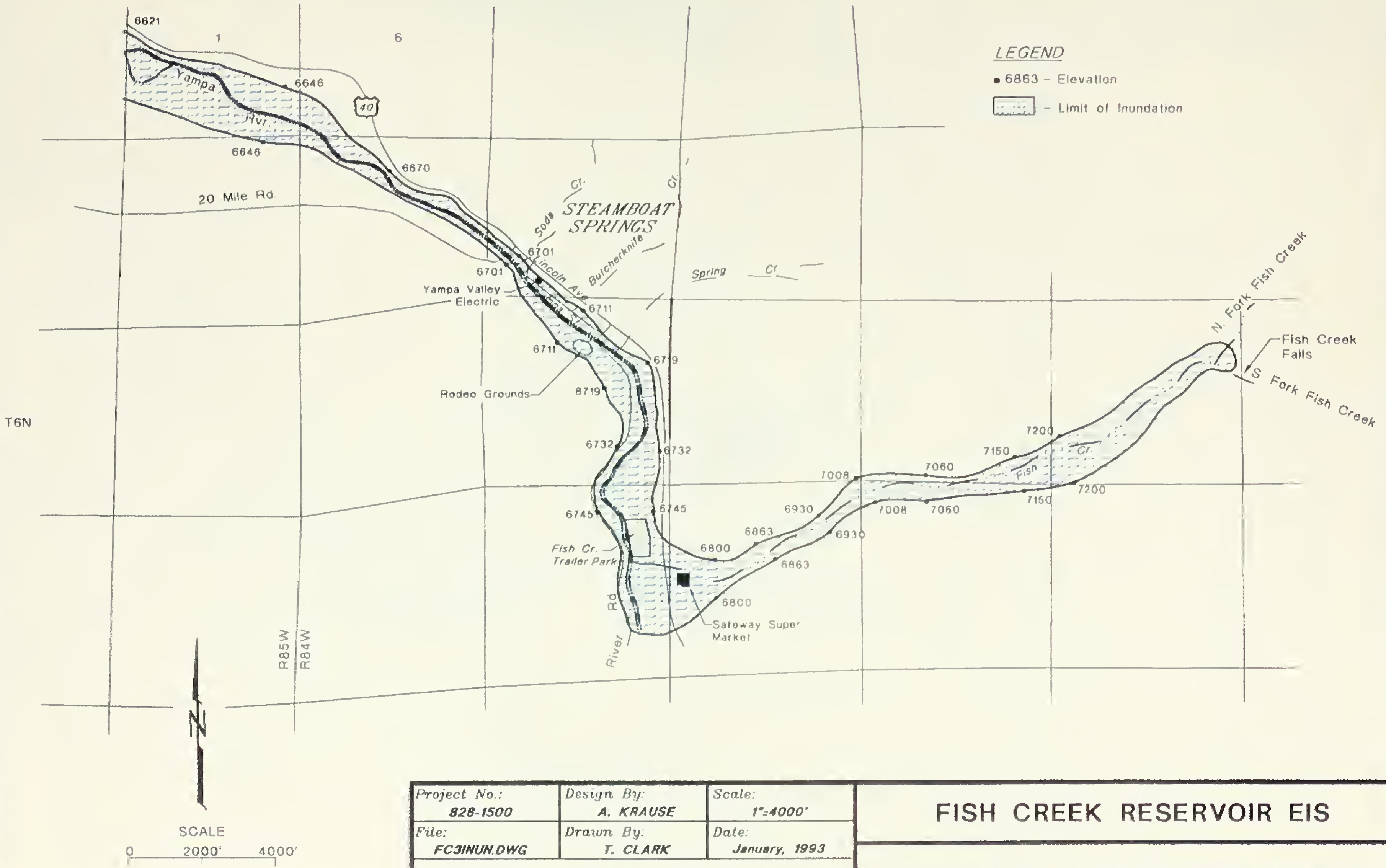

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FIGURE 3-4

FISH CREEK RESERVOIR EIS

FLOOD INUNDATION MAP

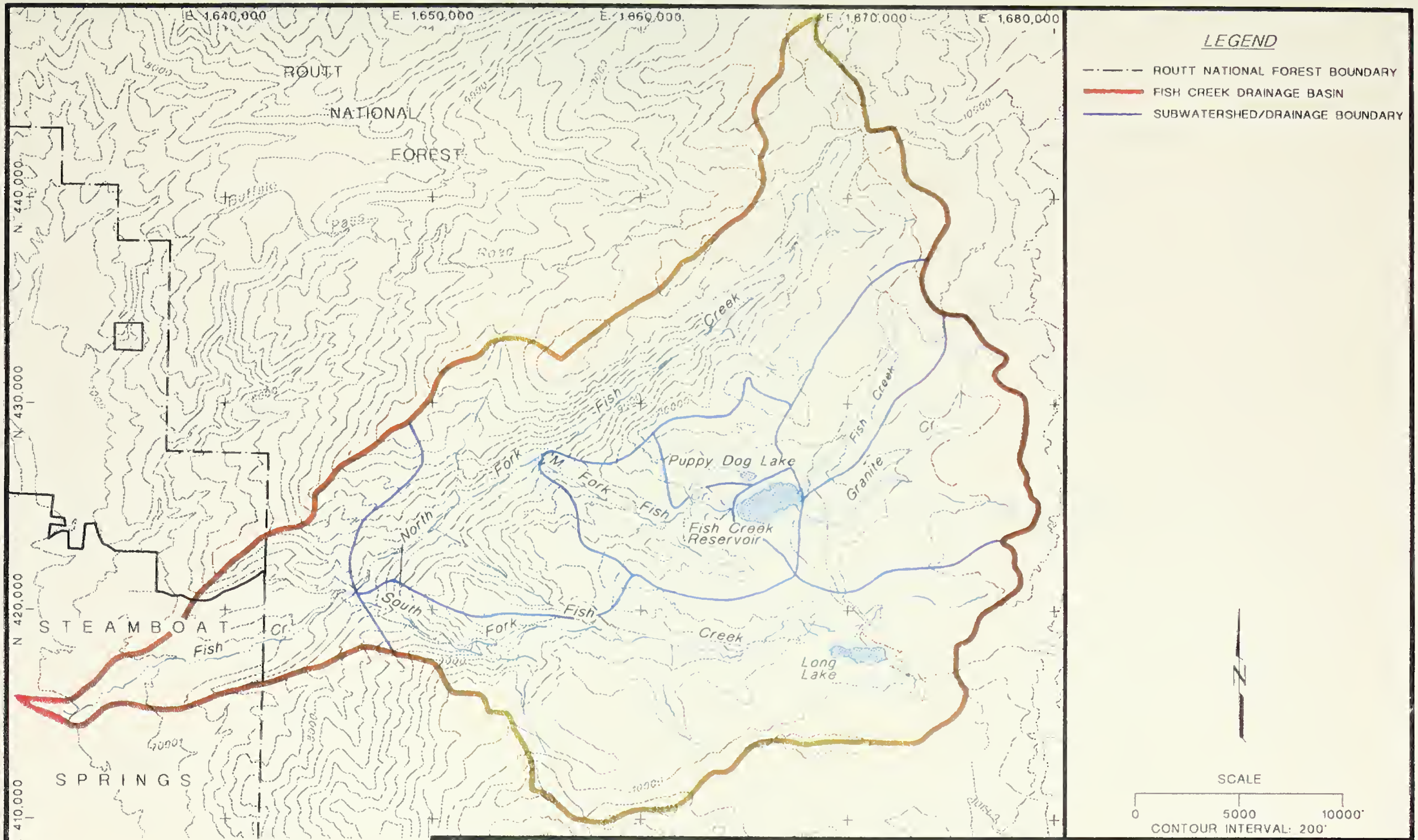

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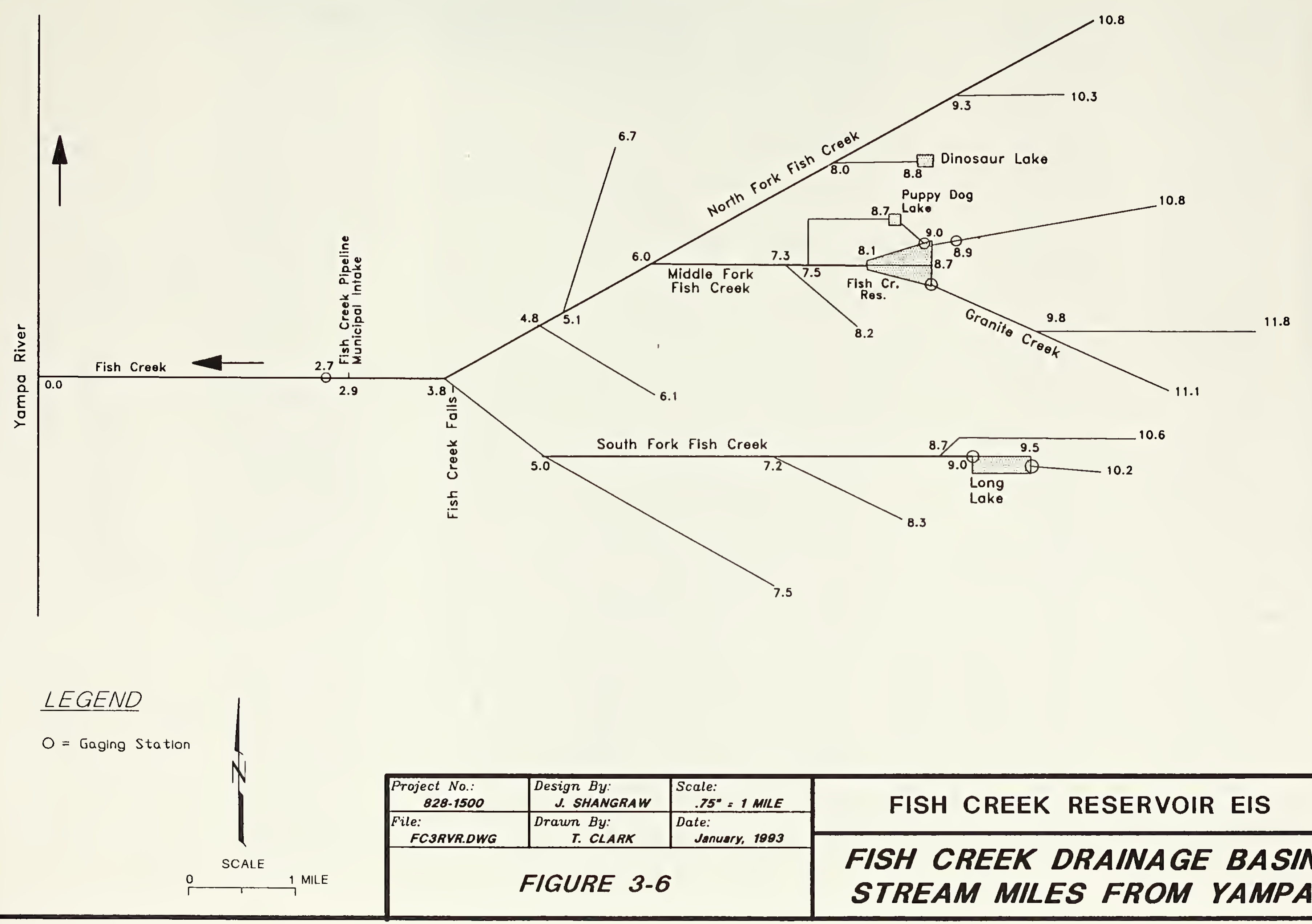
FIGURE 3-5

FISH CREEK RESERVOIR EIS

FISH CREEK DRAINAGE BASIN & WATERSHED BOUNDARIES



Project No.: 828-1500	Design By: J. SHANGRAW	Scale: .75" = 1 MILE
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FIGURE 3-6

FISH CREEK RESERVOIR EIS

FISH CREEK DRAINAGE BASIN STREAM MILES FROM YAMPA

The South Fork of Fish Creek flows west from its headwaters at the Continental Divide. Elevation of the drainage ranges from 10,417 feet to 7,520 at Fish Creek Falls. The South Fork has a channel slope of approximately 0.08 feet/foot and a drainage area of 7.8 square miles. Long Lake Reservoir is located in the upper reaches of the South Fork of Fish Creek and has a capacity of 396 AF. The South Fork of Fish Creek joins the North Fork approximately 5 miles downstream of Long Lake just below Fish Creek Falls.

Fish Creek continues flowing in a southwesterly direction approximately 3.8 miles, to its confluence with the Yampa River. The drainage area for the lower reaches of Fish Creek (Fish Creek Falls to the Yampa River) is 3 square miles. The elevation ranges from 7,520 feet at Fish Creek Falls to approximately 6,720 feet at the confluence with the Yampa River. Channel slope in this reach is approximately 0.04 feet/foot. The diversion point for the water filtration plant is located 0.9 miles downstream of Fish Creek Falls.

3.3.2.3 Project Climatology

In addition to temperature and precipitation data collected in Steamboat Springs and at Buffalo Pass, snow survey data has been collected at Buffalo Pass and has been used to predict average and low flow conditions at the Fish Creek Reservoir site. The SCS has maintained three snow course stations in the general vicinity of Fish Creek Reservoir. The Tower station at Buffalo Pass, located within the North Fork of the Fish Creek drainage basin, was used for these predictions. The Tower station has an average snow water equivalent (SWE) of 50.3 inches over a period of record from 1961 through 1990 (SCS, 1992) as shown in Table 3-2, Snow Water Equivalents. The total annual precipitation of 57.47 inches includes the SWE of 50.3 inches as well as precipitation from rainfall events during the summer months. Snotel data, automated daily precipitation and snow water equivalent data, have also been collected at the Tower site and ten years of data are available for the period 1980 through 1990. The average snow water equivalent at the snotel site is 45.43 inches. The snotel data is considered more detailed and more reliable than the snow course data (SCS, 1992). It is estimated that approximately 85 percent of the snow water equivalent at the Tower site could be expected at Fish Creek Reservoir. Of this 85 percent of the water content, 25 percent is estimated to be lost to evapo-transpiration and seepage, and 75 percent is predicted to be available for runoff, which would flow through Fish Creek Reservoir (D&D, 1983). Based on these estimates, the runoff volume for the Fish Creek drainage at the dam, with an area of 5 square miles, would be 8,550 AF using the average SWE from the snow course data and 7,723 AF using the average SWE from the snotel data.

TABLE 3-2
SNOW WATER EQUIVALENTS (SWE)
TOWER GAGE

Date	SWE - Inches Snow Course	SWE - Inches Snotel
Average 1961-1990	50.3	
Average 1980-1990		45.43
April 1, 1977	25.4	
*April 1, 1981	30.1 (10 year low flow)	23.8
*10-year low flow event		

Drought years for the period of record were 1977 and 1981. The minimum SWE measured at the snow course was 25.4 inches on April 1, 1977. Data at the snotel site was not collected during 1977. The SWE measured at the snow course in April 1981 of 30.1 inches, is considered the 10-year low flow event. In a given 100-year period, there would be 10 years when the snow water content would be less than observed in April 1981 (D&D, 1983). The corresponding 10-year low flow SWE at the snotel site was 23.8 inches. Estimating the water yields from the 10-year low flow event in the same manner as the average SWE results in a runoff volume at the dam of 5,120 AF and 4,050 AF, respectively using the snow course and the snotel site data. A 25-year low flow event means that during a 100-year period this water content or less would be expected to occur four times. The 25-year low flow event is predicted to be approximately 21 inches and would have a corresponding water yield at Fish Creek of 3,570 AF.

Annual evaporative losses from the Fish Creek Reservoir are expected to be less than 25 inches/year (Duskin, 1992). Since evaporative losses are less than the amount of precipitation, there is no net evaporative loss. Evaporative losses could range from 6 inches per year to 20 inches per year. No site specific data, however, is available. Estimated evaporation over the existing average surface area (92.5 acres) of the reservoir could range from approximately 45 to 150 AF per year. Applying the same evaporation rates to Long Lake Reservoir, with a surface area of 57 acres, would yield evaporation rates ranging from approximately 28 to 95 AF per year.

3.3.2.4 Stream Flow Regime

Stream flow has been monitored by the U.S. Geological Survey at six locations within the Fish Creek drainage area. These locations include the South Fork of Fish Creek at the inlet to Long Lake Reservoir (09238705), the South Fork of Fish Creek below the Long Lake spillway (09238710), the Middle Fork of Fish Creek above the Fish Creek Reservoir (09238750), Granite Creek above Fish Creek Reservoir (09238770), the Middle Fork of Fish Creek tributary (Puppy Dog Lake) at the Fish Creek Reservoir spillway (09238800), and Fish Creek below the municipal intake (09238900). Period of record varies for these stations. All of the stations, with the exception of the inlet to Long Lake and Fish Creek below the municipal intake, have a period of record from August, 1984 to the current year. Monitoring commenced at the inlet to Long Lake in October 1986. The lower Fish Creek station was monitored from October, 1966 through September 1972, and was reinstated in May, 1982. A summary of flow records for these stations is found in Table 3-3.

Stream flow estimates at the Fish Creek Reservoir outlet into the Middle Fork of Fish Creek, ranging from 0 to approximately 11 cubic feet per second (cfs), have been recorded by City personnel. During September and October 1992, the reservoir was drained for maintenance at an estimated rate of approximately 20 cfs. An average discharge rate from the reservoir over the period from 1977 through 1992, was approximately 3 cfs. Measurements of stream flow from the outlet are taken several times a month during the months of July through October. Flows at the outlet monitoring site are not always captured in the existing flume, if flow volumes are greater than 10 cfs. Therefore, outlet flow values are estimates only for flows greater than 10 cfs.

TABLE 3-3
SUMMARY OF U.S. GEOLOGICAL SURVEY STREAM FLOW RECORDS

Station Name	Period of Record	Drainage Area (mi^2) at Station Location	Average Flow for Period of Record (cfs)	Maximum Flow for Period of Record (cfs)	Minimum Flow for Period of Record (cfs)
09238705 Long Lake inlet near Buffalo Pass	October, 1984 to current year	0.71	*1.4 (980 AF/year) (avg for 1984-1991 only)	62 - (June 16, 1988)	0- (17 days 1988)
09238710 Fish Creek Tributary below Long Lake	August, 1984 to current year	1.03	1.7 (1,260 AF/year)	81 - (June 14, 1991)	0 - (many days each year)
09238750 Middle Fork Fish Creek near Buffalo Pass	August, 1984 to current year	1.37	3.97 (2,880 AF/year)	178 - (June 15, 1991)	0 - (February 17-20, 1988)
09238770 Granite Creek near Buffalo Pass	August, 1984 to current year	2.82	6.94 (5,028 AF/year)	126 - (June 11, 1990)	0.13 - (March 21, 1988)
09238800 Middle Fork Fish Creek Tributary below Fish Creek Reservoir (spillway)	August, 1984 to current year	4.78	7.78 (5,640 AF/year) 40 cfs (active flow period rather than annual - See section 2.4)	195 - (June 16, 1991)	0 - (many days each year)
09238900 Fish Creek at Upper Station, near Steamboat Springs	October, 1966 to September, 1972 May, 1982 to current year	24.8	*54.47 (38,800 AF/year) (avg for 1984-1991 only)	1,110 - (June 20, 1968)	0.01 - (August 7, 1972)

* No average given in USGS, 1991. Data is from daily flow records obtained from the City for these USGS stations. Averages were calculated from daily records.

(USGS, 1991)

3.3.2.5 Peak Flow Estimates

As discussed in section 3.2.4, Fish Creek Dam is classified as a "Class A, High Hazard" structure. The structure is greater than 20 feet in height and its failure would likely result in a loss of life downstream. Peak flow estimates for the Probable Maximum Precipitation (PMP) event were required in the design of the Fish Creek Reservoir. The inches of precipitation from the PMP with a 6-hour duration were 12.5 for a general type storm, and 9.2 for a local type storm. Resulting peak flow estimates were 3,230 cfs for the general type storm, and 4,809 cfs for the local type storm (D&D, 1983). The total volume of flow in a general type storm is larger than the local type storm. However, the time required to reach the peak in the local type storm is shorter and the peak flow is greater than the general storm.

3.3.2.6 Stream Channel Characteristics

The Middle Fork of Fish Creek below the reservoir is a bedrock controlled channel. The channel is stable and erosion potential slight. The channel carries a higher than normal sediment load downstream of the confluence with Puppy Dog Lake channel for a distance of approximately 0.25 miles. Along this 0.25 mile stream segment, extensive bedload depositional features are apparent. The integrity of the Fish Creek channel downstream of the influence of Puppy Dog Lake channel is good. Banks are stable with heavily wooded and vegetated areas and the channel does not show evidence of excessive erosion.

The Puppy Dog Lake drainage, downstream of the Fish Creek Reservoir spillway, shows signs of long-term bank and channel erosion. The spillway from Fish Creek Reservoir during the months of May, June and July, contributes large volumes of water into the 0.8 square mile drainage area of Puppy Dog Lake, causing considerable erosional damage to the channel. This small watershed receives flows much greater in magnitude than would normally occur in the basin, which causes the stream channel to adjust to the larger flows. These adjustments result in erosional damage. As an example, the average monthly flow from the spillway to Puppy Dog Lake drainage during June 1991 was 82.2 cfs, or 103 cfs per square mile. During that same time period, the average discharge in Granite Creek (located upstream of the reservoir), was 50.9 cfs, or 18 cfs per square mile. Flow on June 16, 1991 of 195 cfs was the maximum discharge for the period of record. Large magnitude discharges from the spillway have changed the natural character of the channel. The channel is approximately 60 feet wide, approximately 1,000 to 2,000 feet downstream of the outlet from Puppy Dog Lake. Evidence of erosion from the extreme flows during June 1991, could be seen on the north banks of the channel. Active bank erosion and several uprooted trees on the north bank were evidence of large magnitude flows.

No information exists to document the Puppy Dog Lake stream channel prior to construction of the reservoir. From the characteristics of the surrounding drainage, it can be assumed that the pre-existing channel was probably a small meandering meadow type stream. The stream channel was probably stable with riparian vegetation along the upper and lower banks. The adjustments that the channel has had to make to accommodate the increased spillway flow volumes once the reservoir was constructed have caused adverse changes in the channel. The progressive stages of channel adjustments have changed the stream to a gully type stream system.

The energy available within the stream channel is increased due to the increased volume of water from the spillway flows during spring runoff. As the velocity increases, the size of the particle that can be transported also increases. This causes the stream to downcut or become incised. As the downcutting proceeds, the channel slope increases due to the stream becoming less sinuous. As the

stream becomes more incised, year after year, there is no longer an opportunity for the increased flows to spread out over the upper banks which dissipates the erosive effects of the high flows. The stream energy is confined within the channel which causes additional channel erosion every year. The stream adjusts laterally within the incised channel increasing the width of the channel in the bottom of the confined stream bed. Vegetation does not become established in a gully type stream system. The channel is currently unstable, deeply incised in some locations, with an absence of riparian vegetation along the upper and lower banks.

3.3.2.7 Existing Operation of Fish Creek Reservoir

Fish Creek Reservoir has a total storage capacity of 1,842 AF of water and a surface water area of approximately 90 acres. The normal water level elevation within the reservoir is 9,866 feet. The embankment crest elevation of the main dam is 9,874 feet and 9,871.5 feet for the saddle dam. The spillway is constructed to contain the probable maximum precipitation event (PMP) with one foot of freeboard.

The recent operation of the Fish Creek Reservoir can be described as an annual cycle of storage and release. The reservoir is filled by runoff and snowmelt from the 5.0 square mile Middle Fork of the Fish Creek watershed, including the Granite Creek and Upper Middle Fish Creek tributaries, from April until the end of May or the beginning of June, when the spillway into the Puppy Dog Lake drainage begins to flow. The average flows recorded for the period of record can be misleading at the spillway gaging site since a vast majority of the runoff occurs over the three-month period of May, June, and July. Averages in Table 3-3 are calculated over the period of a year. Flow from the spillway occurs for an average (7-year period of record) of 71 days a year. Average flow when the spillway is active for water years 1984 through 1990 is 40 cfs. As shown in Table 3-3, the maximum flow for the period of record was 195 cfs.

The outlet works at the main dam are adjusted in July to release approximately 4 to 5 cfs of storage water to the existing flow in the Middle Fork of Fish Creek for the summer irrigation season and to allow release of inflow from the upper tributaries. Flow from the outlet is reduced in the late fall to approximately 2 to 3 cfs (Birch, 1992b). Drawdown from storage during the fall and winter months (August through April or May) is approximately 1,000 to 1,200 AF per year (Birch, 1992a).

3.3.2.8 Existing Operation of Long Lake Reservoir

Long Lake Reservoir has an active storage capacity of 396 AF and a surface water area of 57 acres. The normal water level elevation within the reservoir is approximately 9,850 feet. The embankment crest elevation of the main dam is approximately 9,853 feet. The active spillway channel is 10 feet wide. However, the effective spillway channel width is several hundred feet.

Long Lake Reservoir is used to augment the storage capacity in Fish Creek Reservoir. Approximately 25 percent of the total water storage released by the City annually comes from Long Lake. Long Lake is also a backup water supply used when Fish Creek Reservoir requires maintenance. The reservoir is filled by runoff and snowmelt from a drainage area of approximately 0.71 square miles from April until the end of May or the beginning of June. The reservoir outlet normally remains open throughout the year. The spillway flows from approximately June through July. Inflow to the reservoir drops in August and the spillway does not flow. Flows of approximately 1 cfs are released through the outlet structure from August through the winter. Annual drawdown from storage in Long Lake is approximately 300 AF. Some dead storage exists when the reservoir is completely drained (Birch, 1992a).

3.3.3 Water Rights

The City and Mt. Werner own a portfolio of direct flow water rights and storage water rights on Fish Creek and other area streams. The following sections will discuss direct flow rights, storage rights, and water rights outside of the Fish Creek drainage. Both the City and Mt. Werner have groundwater rights tributary to the Yampa River. Figure 3-7, Watershed Boundaries and Water Rights, shows the location of water rights within the Fish Creek drainage.

3.3.3.1 Fish Creek Direct Flow Water Rights

A summary of Fish Creek direct flow water rights by priority, using the administration number, which has recently replaced the use of basin rankings, is shown in Table 3-4, Summary of Fish Creek Direct Flow Water Rights.

All of the direct flow water rights owned by the City have been consolidated to a diversion point at the water filtration plant. The Fish Creek Municipal Intake consists of water rights with adjudication dates ranging from 1892 to 1972. Water rights transferred from the Hoyle and Knight ditch, the Welch and Waters ditch, and the Batton ditch, have all been changed to divert from the municipal intake. The total direct flow rights available to the City at the intake is 15.088 cfs. The City has a 25 percent share of the senior 8.3 cfs Fish Creek direct flow water rights.

Mt. Werner has also consolidated all of its direct flow water rights to the Fish Creek Municipal Intake. The sources for the transfers include the Hoyle and Knight ditch, the Welch and Waters ditch, and Park City Number (No.) 2 ditch. Mt. Werner has direct flow water rights totaling 21.888 cfs. It has dedicated 7.1 cfs of this total to the Colorado Water Conservation Board, as indicated in Table 3-4. Mt. Werner has a 63 percent share of the senior 8.3 cfs Fish Creek direct flow water right.

Table 3-4, Summary of Fish Creek Direct Flow Water Rights, lists water rights from the highest to the lowest priority within the basin. The first four water rights listed in the tabulation comprised the original Hoyle and Knight water right for 8.3 cfs. As discussed previously, the City has a 25 percent share and Mt. Werner a 63 percent share of this senior water right. During periods of low flow, only this Hoyle and Knight first right of 8.3 cfs is in priority. Therefore, the three owners of this right must abate proportionately when the flow in Fish Creek drops below 8.3 cfs. During this period, there is not sufficient water within Fish Creek to meet municipal water demands, and consequently, water must be released from storage.

The Sheraton Golf Course has an agreement with Mt. Werner to use an existing portion of Mt. Werner direct flow rights in Fish Creek for irrigation of the golf course. Administratively, Sheraton Golf Course diversions are monitored by the Colorado Division of Water Resources, however, the water right is still retained by Mt. Werner (Holt, 1992a).

There are several active direct flow rights remaining in the Fish Creek drainage that are not owned by the City or Mt. Werner. The Hoyle and Knight ditch still retains a direct flow water right of 1.0 cfs for irrigation use with an adjudication date of 1892. The Albert Mann ditch has a total of 3.61 cfs for irrigation and recreation use with adjudication dates ranging from 1904 through 1919.

TABLE 3-4
SUMMARY OF FISH CREEK DIRECT FLOW WATER RIGHTS
ADMINISTRATIVE LISTING

Administration No.	Diversion Structure Name	Amount (cfs)	Use	Source and Comments	Diversion Structure Total (cfs)
14466.00000	Fish Cr Mun Water Intake	2.00	Mun.	Steamboat Springs from Hoyle & Knight	2.00
14466.00000	Fish Cr Mun Water Intake	5.12	Many	Mt. Werner from Hoyle & Knight	7.12
14466.00000	Fish Cr Mun Water Intake	0.176	Mun.	Mt. Werner & Steamboat Springs from Hoyle & Knight	7.3
14466.00000	Hoyle & Knight D	1.00	Irr.	7.124 cfs to Fish Cr Pl, 0.176 cfs to Fish Cr Mun intake*	1.00
19985.18830	Albert A Mann D	0.370	Irr., Rec. Fishery Stock	From Welch & Waters	0.370
19985.18830	Fish Cr Mun Water Intake	1.30	Fire, Dom.	Steamboat Springs.from Welch & Waters	8.6
19985.18830	Fish Cr Mun Water Intake	1.74	Irr.	Mt. Werner from Welch & Waters	10.3
22438.22048	Fish Cr Mun Water Intake	2.56	Irr.	Mt. Werner from Hoyle & Knight; 2 cfs dedicated to CWCB	12.9
22544.22156	Fish Cr Mun Water Intake	3.42	Irr.	Mt. Werner from Welch & Waters	16.3
23646.15888	Park City Main Lat 1	0.330	Irr.	Park City Decree from Albert A Mann	0.330
23646.21742	Albert A Mann D	1.33	Irr., Rec. Fishery Stock	Change of Use	1.7
23646.22531	Albert A Mann D	0.660	Irr., Rec. Fishery Stock	Change of Use	2.36
25392.21742	Albert A Mann D	1.25	Irr., Rec. Fishery Stock	Change of Use	3.61
26805.26495	Fish Cr Mun Water Intake	1.5	Fire, Dom.	Steamboat Springs from Fish Cr Pl	17.8
33782.19875	Alma M Baer Feeder Ditch	0.336	Irr.		0.366
34546.00000	Fish Cr Mun Water Intake	2.10	Irr.	Mt Werner from Welch & Waters; dedicated to CWCB	19.9
35320.33181	Fish Cr Mun Water Intake	3.00	Irr., Dom.	Steamboat Springs from Batton & Batton	22.9
35320.35215	Fish Cr Mun Water Intake	3.70	Irr., Dom.	Steamboat Springs from Batton & Batton	26.6
37688.283972	Fish Cr Mun Water Intake	1.00	Stock	Mt Werner from Hoyle & Knight; dedicated to CWCB	27.6
37688.33723	Fish Cr Mun Water Intake	1.00	Stock	Mt Werner from Hoyle & Knight; dedicated to CWCB	28.6
39254.20223	Park City Main Lat 1	0.30	Irr., Dom.	0.4 cfs to Fish Cr Park Well No. 1, 0.3 cfs to Well No. 2	0.63

TABLE 3-4
SUMMARY OF FISH CREEK DIRECT FLOW WATER RIGHTS
ADMINISTRATIVE LISTING

Administration No.	Diversion Structure Name	Amount (cfs)	Use	Source and Comments	Diversion Structure Total (cfs)
39254.20223	Fish Cr Park Well No. 1	0.40	Mun., Fire Dom.	From Park City No. 1 Actually Alt Point of Diversion	2.00
39254.20223	Fish Cr Park Well No. 2	0.30	Mun., Fire Dom.	From Park City No. 1 Actually Alt Point of Diversion	0.30
40329.00000	Alma M Baer Feeder Ditch	1.50	Irr.		1.87
41457.00000	Fish Cr Mun Water Intake	1.00	Irr.	Mt Werner from Park City No. 2; dedicated to CWCB	29.6
41851.00000	Fish Cr Mun Water Intake	3.50	Irr., Mun., Dom.	Steamboat Springs from Fish Cr Pl	34.30
42156.00000	Fish Cr Mun Water Intake	2.70	Irr., Mun., Dom.	Mt. Werner from Mt Werner Pl	34.30
42156.00000	Fish Cr Mun Water Intake	2.70	Irr., Mun., Dom.	Mt. Werner from Mt Werner Pl	37.00
42925.00000	Green Well & Pl	0.50	Irr., Dom., Stock		0.50
44559.20223	Park City Main Lat 1	1.67	Irr., Stock		2.30
44925.41829	Clayson Well 1	0.252	Irr.		0.252
46652.00000	Fish Cr MSF	0.40	Minimum Stream Flow	Outlet Long Lake to No Fk Fish Cr	0.30
47189.00000	Fish Cr MSF Lower	0.40	Minimum Stream Flow	Mt Werner Pl to Yampa River	2.00
47189.00000	Fish Cr MSF	0.40	Minimum Stream Flow	Conf No Fk to Mt Werner Pl	0.30
50769.50604	Lodwick Pond Outlet D	2.00	Irr., Rec., Fishery Stock		2.00

Notes: No direct flow rights less than .1 cfs have been included.
Listing includes direct diversions only.
Listing includes absolute rights only.
*Steamboat Ski Corp has first right of refusal and Mt. Werner has the second right of refusal for the purchase of this right

(Colorado Division of Water Resources, Division 6, 1992)

The Alma Baer Feeder ditch has a total of 1.866 cfs for irrigation with adjudication dates of 1946 and 1964. The Park City Main Lat. No. 1 has a total of 2.3 cfs for irrigation and stock use with an adjudication date of 1964. Two wells, Park City Well No. 1 and 2, decreed for 0.4 and 0.3 cfs, respectively, and adjudicated in 1964 have been transferred from the Park City Main Lat. No. 1 as alternative points of diversion. The Lodwick Pond ditch has a 1989 adjudication date for 2.0 cfs for irrigation and recreational purposes. The source of water for this ditch is actually the Albert Mann ditch (Holt, 1992b).

The Delonge and Kelly ditch has a headgate on the North Fork of Fish Creek. This water right is decreed for 4 cfs with an adjudication date of 1901 for irrigation and domestic use. The Goumaz and Hang ditches are adjudicated in the Little Fish Creek drainage for a total of 3.3 cfs. The source for these water rights is the Delonge and Kelly ditch, not Little Fish Creek where they are physically located. Because the source for these water rights is another adjudicated water right, they are administered through the Delonge and Kelly ditch (Holt, 1992b).

The Green Well and Pipeline was adjudicated in 1972 for 0.5 cfs for irrigation, domestic and stock use. The Green Well is located near the mouth of Fish Creek. The Clayson Well 1 is located in the Little Fish Creek drainage and is used for irrigation. It has an adjudication date of 1972 for 0.252 cfs.

Several springs are also adjudicated in the Fish Creek drainage. Wildlife Water Spring adjudicated in 1987 for 0.033 cfs for "other" use, and Fish Creek Spring for a total of 1.004 cfs on the North Fork, adjudicated in 1975 for domestic use.

Four Counties Water has a total of 573 cfs listed in the July 1992 water rights tabulation. However, all of these rights have been transferred out of the Fish Creek Basin. Alternative points of storage and diversion were previously decreed for these rights outside of the Fish Creek Basin. However, the City may obtain a portion of the Four Counties Rights on Fish Creek form the Upper Yampa Water Conservancy District for use on the proposed project.

3.3.3.2 Fish Creek Minimum Stream Flow Rights

Minimum stream flow rights have been adjudicated at eight points within the Fish Creek drainage by the Colorado Water Conservation Board (CWCB). These rights are junior to the City and Mt. Werner's direct flow rights, and also to the City's existing storage rights. They are senior to the conditional storage right on Fish Creek for 2,000 AF. However, no objection by the CWCB was made at the time of application by the City for the 2,000 AF storage right. An additional 200 AF storage right was filed in August 1992 by the City. The CWCB rights are senior to this filing. Listed below in Table 3-5 by drainage, are the locations, amounts and adjudication dates of these rights. Figure 3-7, Watershed Boundaries and Water Rights, shows the stream reaches affected by minimum stream flow rights.

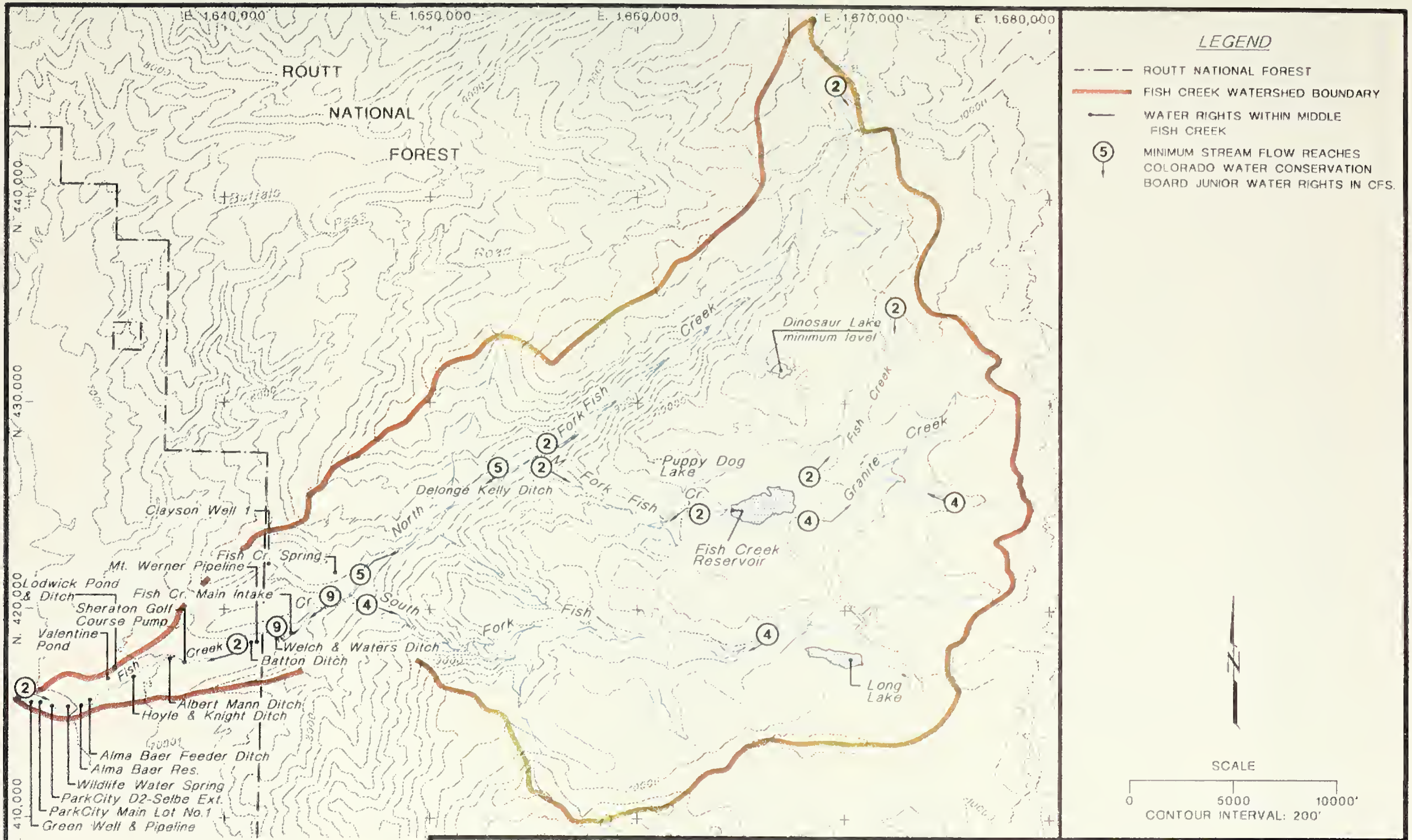

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FIGURE 3-7

FISH CREEK RESERVOIR EIS

WATER RIGHTS

TABLE 3-5 MINIMUM STREAM FLOW RIGHTS		
Reach Location	Amount, in cfs	Adjudication Date
Outlet of Long Lake to confluence of South Fork Fish Creek with North Fork	4.0	12/31/77
Mt. Werner PL to Yampa River	2.0	12/31/79
Confluence of North Fork to Mt. Werner PL	9.0	12/31/79
Headwaters of Granite Creek to Fish Creek Reservoir	4.0	12/31/77
Headwaters of Middle Fork to Fish Creek Reservoir	2.0	12/31/77
Fish Creek Reservoir to confluence with North Fork Fish Creek	2.0	12/31/77
Headwaters of North Fork to confluence with Middle Fork Fish Creek	2.0	12/31/77
Confluence of Middle Fish Creek to Fish Creek below falls	9.0	12/31/77

3.3.3.3 Fish Creek Storage Rights

The City of Steamboat Springs owns 99 percent of the storage rights on the Middle Fork of Fish Creek and the South Fork of Fish Creek. Fish Creek Reservoir on the Middle Fork of Fish Creek has three adjudicated storage rights: 1,175.43 AF (1946), 666.63 AF (1964), and 2,000 AF (1980). An additional storage right was filed in August 1992 by the City for 200 AF.

The Colorado Water Conservation Board has filed an objection to this most recent 200 AF filing. Two minimum stream flow rights (adjudication dates 12/31/77) located at the inlet to Fish Creek Reservoir on approximately 100 feet of the Middle Fork of Fish Creek and Granite Creek, would be affected. The two parties have settled this objection through an agreement dated December 31, 1992 which is included as Appendix G. According to the agreement, the City would use the 200 AF of storage capacity to release water during low flow periods for the maintenance of in-stream flows downstream of the Fish Creek Water Filtration Plant. The Colorado Division of Water Resources would administer this arrangement (Holt, 1993). Additionally, the City would use its "best efforts" to improve aquatic habitat in lower Fish Creek by constructing habitat improvement structures, in an amount not to exceed $10,000.

The City also owns storage rights to Long Lake in the amount of 395.6 AF, with an adjudication date of 1946. Several additional conditional water rights are still listed in the tabulations for the Fish Creek basin; one for 308.1 AF and another for 455.0 AF. It is unlikely that these conditional rights will be exercised.

Mt. Werner Water and Sanitation District does not independently own any storage rights in Fish Creek or Long Lake.

Several other entities own storage rights in the Fish Creek basin. Dinosaur Lake, located on the North Fork of Fish Creek, has an adjudication date of 1976 for 130.5 AF for a fishery. This water right was filed by the Colorado Water Conservation Board to maintain a minimum lake level in Dinosaur Lake. The Lodwick Pond, located in the lower reaches of Fish Creek, below the water filtration plant, has an adjudication date of 1989. It was decreed for 13.03 AF for irrigation, recreation, and fishery use. The Albert Mann ditch supplies water to Lodwick Pond. The Valentine Pond was decreed in 1989 for 1.82 AF for irrigation and recreation uses. It is located just southwest of Lodwick Pond. Alma Baer Reservoir, located downstream of Valentine Pond, is decreed for 2.59 AF with a 1946 adjudication date for fishery and domestic use.

3.3.3.4 Water Rights Outside of The Fish Creek Drainage

Both the City and Mt. Werner own water rights in other basins. The City has water rights in the Spring Creek, Soda Creek, and Stuckey Creek basins. The City has converted these rights in order to use raw water, rather than treated water, for irrigation within the City park system. At present, the City has conditional alluvial ground water rights along the Yampa River for its infiltration gallery (Holt, 1992b).

Mt. Werner owns surface water rights on Burgess Creek, and Walton Creek. These water rights are rarely, if ever, used. Absolute ground water rights for Mt. Werner total 6.78 cfs. Mt. Werner also has a conditional water right for an additional 0.71 cfs. These ground water rights are located in alluvium near the confluence of Walton Creek and the Yampa River (Holt, 1992b).

Both the City and Mt. Werner lease water storage in Stagecoach Reservoir, located approximately 5 miles southeast of the town of Oak Creek, Colorado. The City and Mt. Werner have long-term (thirty year) renewable leases of 500 AF and 200 AF of water storage, respectively.

Mt. Werner also leases water storage in Yamcola Reservoir, located in the headwaters of the Yampa River upstream of Stagecoach Reservoir. Mt. Werner has a thirty year renewable lease of 300 AF of water storage in Yamcola.

3.3.4 Water Quality

3.3.4.1 Fish Creek

The City and Mt. Werner obtain their water supply primarily from the high mountain snowmelt sources of the Fish Creek drainage basin. As discussed previously, the City and Mt. Werner own direct flow rights on Fish Creek and the City owns storage rights on Fish Creek Reservoir. Fish Creek Reservoir and Fish Creek, flowing through National Forest lands are designated as High Quality 2 and thus, warrant special protection and review by the Colorado Department of Health (CDH) Water Quality Control Division (WQCD) in order to maintain the existing water quality.

Fish Creek and Fish Creek Reservoir are classified as:

- Aquatic Life Cold 1
- Recreation 1
- Water Supply
- Agriculture

Water quality standards associated with these classifications are presented in Table 3-6.

This highly oxygenated water source is characterized by low alkalinity and hardness and a neutral pH. The water is low in naturally-occurring earth minerals, metals, and organic material. In general, the water is low in turbidity and dissolved solids. During spring snowmelt, however, the concentrations of these parameters tend to increase slightly (Peterson, 1992).

TABLE 3-6
WATER QUALITY STANDARDS

Physical and Biological	Inorganic (mg/l)		Metals (mg/l)		
dissolved oxygen-6.0 mg/l dissolved oxygen(sp)-7.0 mg/l pH-6.5 - 9.0 fecal coliforms-200/100ml	un-ionized ammonia as N (ac)-0.43 /FT/FPH/2 un-ionized ammonia as N (ch)-0.02 residual chlorine-0.003 free cyanide-.005 sulfide as undissociated H_2S (hydrogen sulfide)-0.002	boron-0.75 nitrite as N-0.05 nitrate as N-10.0 chloride-250.0 sulfate-250.0	arsenic(ac)-50(Trec) cadmium(ac)-TVS(tr) cadmium(ch)-TVS trivalent chromium(ac)-50 (Trec) hexavalent chromium(ac/ch)-TVS hexavalent chromium(ch)-TVS copper(ac/ch)-TVS	iron(ch)-300(dis) iron(ch)-1,000(Trec) lead(ac/ch)-TVS manganese(ch)-50(dis) manganese(ch)-1,000(Trec) mercury(ch)-.01(Trec) nickel(ac/ch)-TVS	selenium(ac)-10(Trec) silver(ac)-TVS silver(ch)-TVS(tr) zinc(ac)-TVS zinc(ch)-TVS

ac-acute
ch-chronic
dis-dissolved
mg/l-milligrams per liter
ml-milliliters

N-nitrogen
SP-spawning
tr-trout
Trec-total recoverable
TVS-table value standard

Fish Creek Reservoir is a high quality water source. The management prescription for the area surrounding the reservoir, as identified in the *Routt National Forest Land and Resource Management Plan* is 10E which provides for management of municipal and supply watersheds. A general description and goals of the 10E prescription are as follows:

> *"Management emphasis is to protect or improve the quality and quantity of municipal water supplies. Management practices may vary from use restrictions to water resource improvement practices, with the primary object of meeting water quality standards established from the individual watershed. A secondary objective is to manage the watershed to improve the yield and timing of water flows, consistent with water quality requirements (USDA Forest Service, 1983)"*

Several additional uses are permitted in the area. The area is utilized as a recreation resource, as discussed in the *"Baseline Recreation Report for the Fish Creek Reservoir Expansion EIS"* (ACZ, 1992). Additionally, grazing is presently permitted in the area as discussed in the *"Vegetation and Range Technical Memorandum for the Fish Creek Reservoir Expansion EIS"* (Cedar Creek, 1992b). The registered permittee is the Stratton Sheep Company of Rawlins, Wyoming, who operates one band of sheep (1,000 ewe/lambs), with a season of use between July 16 and September 1 of each year. Grazing, however, is not permitted within 500 feet of Fish Creek Reservoir.

Water from Fish Creek is treated at the Fish Creek Filtration Plant, prior to distribution into the water system. The treatment process entails filtration for the removal of particulates (such as giardia cysts), chemical treatment for corrosion control, and chlorination for disinfection (Peterson, 1992). A schematic of the plant processes is portrayed in Figure 3-8.

In order to meet the requirements of the *Safe Drinking Water Act* (SDWA), water from the filtration plant is analyzed on an annual basis for several general parameters, inorganics, and regulated metals. The results of these analyses for the past 3 years is presented in Table 3-7. Additional requirements of the SDWA include the analyses of herbicides, pesticides, gross alpha and gross beta radiation, and volatile organic compounds. Recent analyses for these parameters indicate that the treated water is of high quality and meets all of the SDWA requirements.

A recent amendment to the SDWA requires that water from "high-risk" homes be analyzed for lead and copper. "High-risk" homes are those which have lead service lines and/or interior lead pipes, plumbing, or solder. Such homes have been identified in the City and the Mt. Werner district and a testing program has been initiated.

3.3.4.2 Yampa River Infiltration Galleries

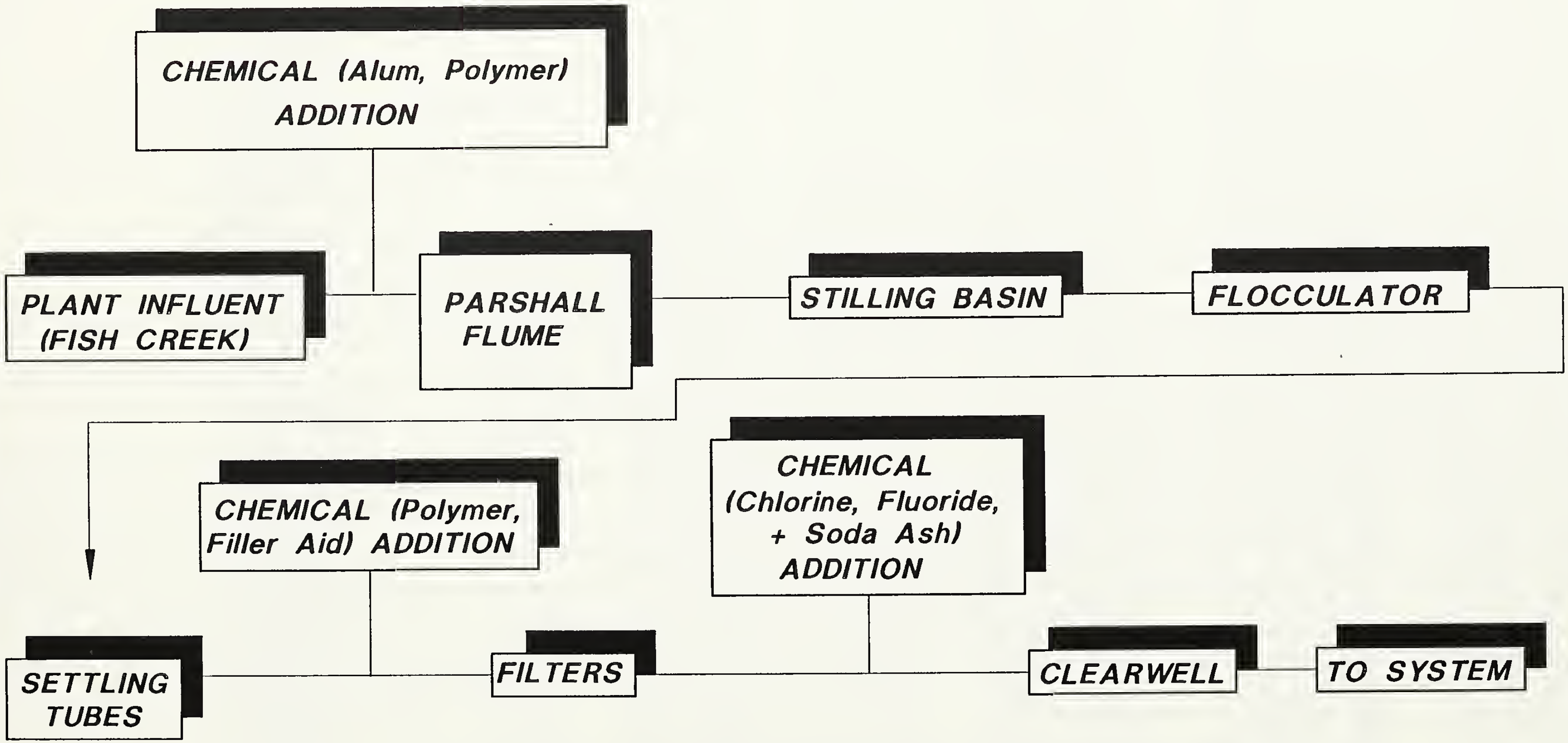
In addition to the main water supply provided by Fish Creek, the City and Mt. Werner maintain three infiltration galleries (well fields) to supply water to the community during peak demands. The well fields also provide redundancy to the water system and a back-up supply for emergency situations (CDC, 1991). The well fields are fairly shallow (approximately 20 to 30 feet deep) and draw alluvial groundwater from the Yampa basin.

TABLE 3-7
FISH CREEK FILTRATION PLANT WATER QUALITY DATA

	February 1990 (mg/l)[1]	March 1991 (mg/l)[1]	March 1992 (mg/l)[1]	Drinking Water Standards (mg/l)
Alkalinity (as $CaCO_3$)	28	30	18	
Bicarbonate Alkalinity (as $CaCO_3$)	28	30	18	
Carbonate	0	0	0	
Calcium (Dissolved)	4	4	4	
Corrosivity	-1.1 LI[2]	-2.1 LI	-2.4 LI	
Fluoride	0.91	0.93	1.3	4.0
Nitrate/Nitrite (as N)	0.06	0.07	0.08	
Nitrite (as N)	<0.01	<0.01	<.01	
Nitrate (as N)	0.06	0.08	0.08	10.0
pH	7.2 units	6.9 units		
Sodium	11	6	7	
Total Dissolved Solids	30	44	38	500[3]
Arsenic	<0.001	<0.001	0.002	0.05
Barium	<0.01	<0.01	<0.01	1.0
Cadmium	0.0001	<0.0001	<0.0001	0.01
Chromium	0.01	<0.01	<0.01	0.05
Lead	<0.001	.002	<0.001	0.05
Mercury	<0.0001	<0.0001	<0.0001	0.002
Selenium	<0.001	<0.001	.002	0.01
Silver	<0.01	<0.0005	<0.0005	0.05

[1]-All units in mg/l unless otherwise specified
[2]-LI = Langelier Index
[3]-Secondary Drinking Water Standard

FISH CREEK FILTRATION PLANT SCHEMATIC



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File: FC3SCH.DWG	Drawn By: T. CLARK	Date: January, 1993	FISH CREEK FILTRATION PLANT SCHEMATIC

FIGURE 3-8

The groundwater in the Yampa basin has a relatively high mineral content and, therefore, is not as high in quality as the Fish Creek water. The well field water is generally higher in alkalinity, hardness, and dissolved solids than the Fish Creek source. Additionally, the alluvial groundwater has relatively high concentrations of iron and manganese and, on occasions, has exceeded the secondary drinking water standards for these parameters (CDC, 1991; MWW&SD, 1992). While iron and manganese are not suspected to cause any health concerns, they are known to create aesthetic impacts such as objectionable taste and odor, and staining of fixtures. Several pools in town, including the Steamboat Springs Health and Recreation Association (SSHRA) pool, have experienced water quality problems when the well fields have been operated. A letter to City Council expressing the concerns of SSHRA is presented in Appendix D. Water quality data for the three well fields are displayed in Table 3-8.

TABLE 3-8
WELL FIELDS WATER QUALITY DATA
JUNE 1992

	Well Field A (mg/l)	Well Field G (mg/l)	Well Field H (mg/l)	Secondary Standards (mg/l)
Total Alkalinity (as $CaCO_3$)	132	130	128	
Bicarbonate Alkalinity (as $CaCO_3$)	132	130	128	
Carbonate Alkalinity (as $CaCO_3$)	0	0	0	
Calcium (dissolved)	35	34	30	
Hardness (as $CaCO_3$)	129	126	116	
Magnesium (dissolved)	10	10	10	
Ammonia Nitrogen	<.05	<.05	<.05	
Total Dissolved Solids	176	13[illegible]	134	500
Total Suspended Solids	<2	<2	<2	
Copper (Total)	.02	.01	.01	1
Iron (Total)	.02	.18	.54	0.3
Manganese (Total)	.40	.05	.46	0.05

Water from the well fields undergoes minimal treatment, in the form of chlorination and fluoridation (Peterson, 1992). The water is then pumped into the distribution system. If the well fields were to be expanded, or utilized to a greater extent, additional treatment would likely ensue. Further treatment for the removal of iron and manganese would be considered. Additionally, it is likely that filtration would be required if particulate analyses revealed that the shallow groundwater source was under the influence of surface conditions (Chubrilo, 1992). Substantial additional treatment, beyond iron and manganese removal and filtration, would be required to produce a water of equal quality to the Fish Creek water.

3.3.5 Water System

3.3.5.1 Study Area

A water service study area has been defined that includes the City of Steamboat Springs, the Mt. Werner Water and Sanitation District, and areas that are likely to be served by either the City or Mt. Werner within the next twenty years. Mt. Werner does not anticipate that its service area will be expanded in the future. The City, however, projects that it will eventually serve beyond its present boundaries to Steamboat II. Additionally, any water main constructed between the present City limits and Steamboat II, would likely be sized to serve the intervening area that could be served by gravity. This includes the area between the City and Steamboat II, north of Highway 40, to an elevation of 6,900 feet (Birch, 1992b).

Figure 3-9 depicts the water planning area. It details the planning area as follows:

- Present Service Area
  - City of Steamboat Springs Service Area (A)
  - Mt. Werner Water and Sanitation District (B)

- Additional Future Service Area
  - Steamboat II (C)
  - Area between City and Steamboat II (D)

The City believes that providing Steamboat II and the intervening area with treated water is consistent with the community goal of fostering moderate income housing. Water could be provided to this area with or without annexation. The City, however, has indicated that water service could be tied to eventual annexation (Birch, 1992b).

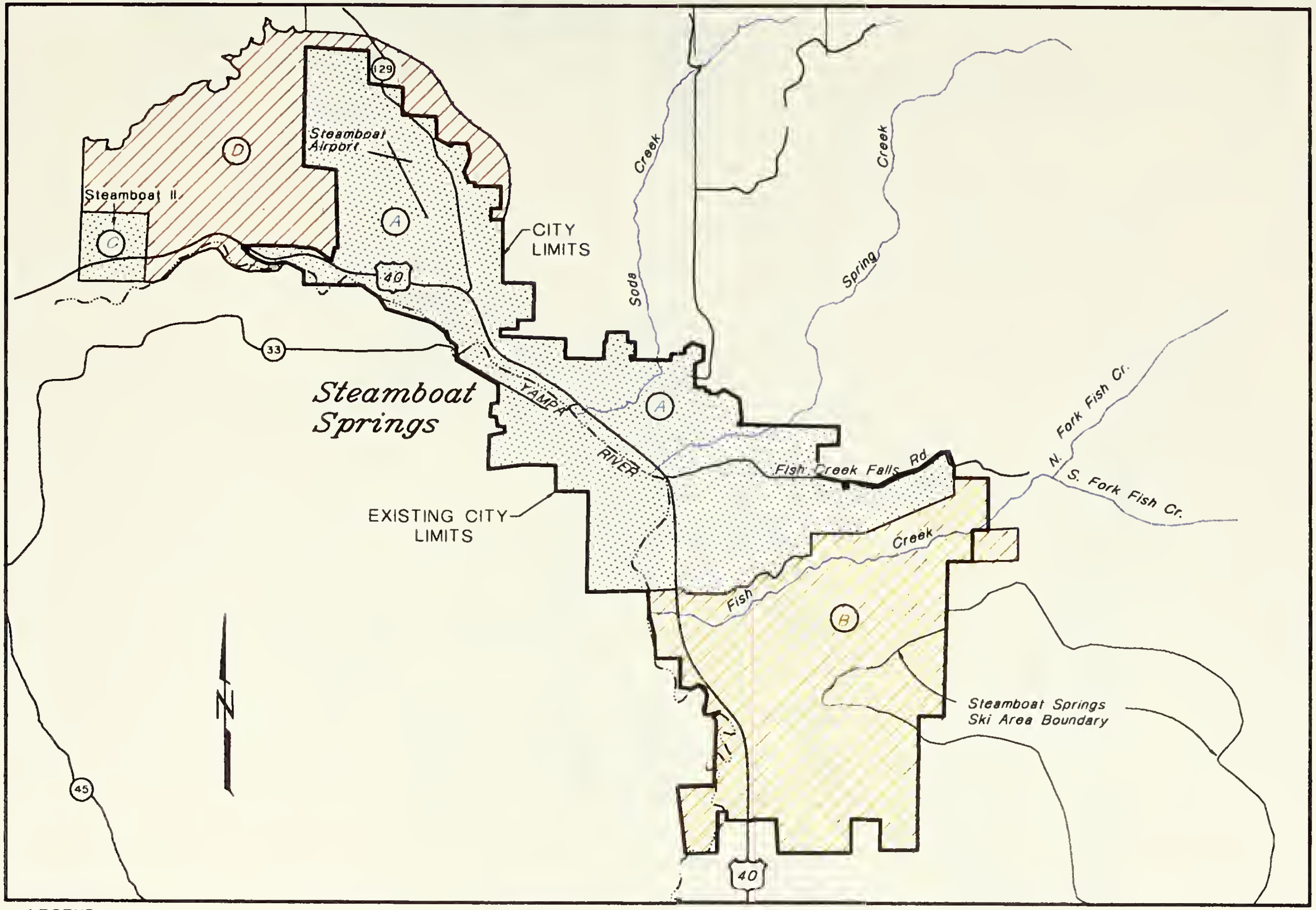
3.3.5.2 Water Providers

The City and Mt. Werner are the major water providers in the service area. The City is a municipal water provider and Mt. Werner is a quasi-municipal subdivision of the State of Colorado under the special district law. It was created in 1967 to provide water and sewer services to the developing ski area. Other minor water providers in the area include Ski Town Campground, Sleepy Bear Mobile Home Park, Treehaus, Steamboat II, Steamboat Ski Area, and Whitehaven Mobile Home Park. Riverside has recently been tied into the City water system.

3.3.5.3 Existing Facilities

Following is a summary of the major facilities within the City and Mt. Werner water systems. A further detailed description of these facilities is found in the *Water Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992b). Figure 3-10, Water System Facilities shows the location of the water system facilities.

The City water system consists of a two-third interest (with Mt. Werner) in the 4.5 million gallon per day (MGD) Fish Creek Water Filtration Plant; the Yampa River infiltration galleries capable of providing approximately one MGD of water; three potable water storage tanks with a total capacity of 3.25 million gallons (MG); one pumping station; and approximately 40 miles of water distribution lines (Birch, 1992c).



LEGEND

Service Area Boundaries

- (A) - City of Steamboat Springs (Exluding Mt. Werner)
- (B) - Mt. Werner Water and Sanitation District
- (C) - Steamboat II
- (D) - Potential Service Area Between City and Steamboat II

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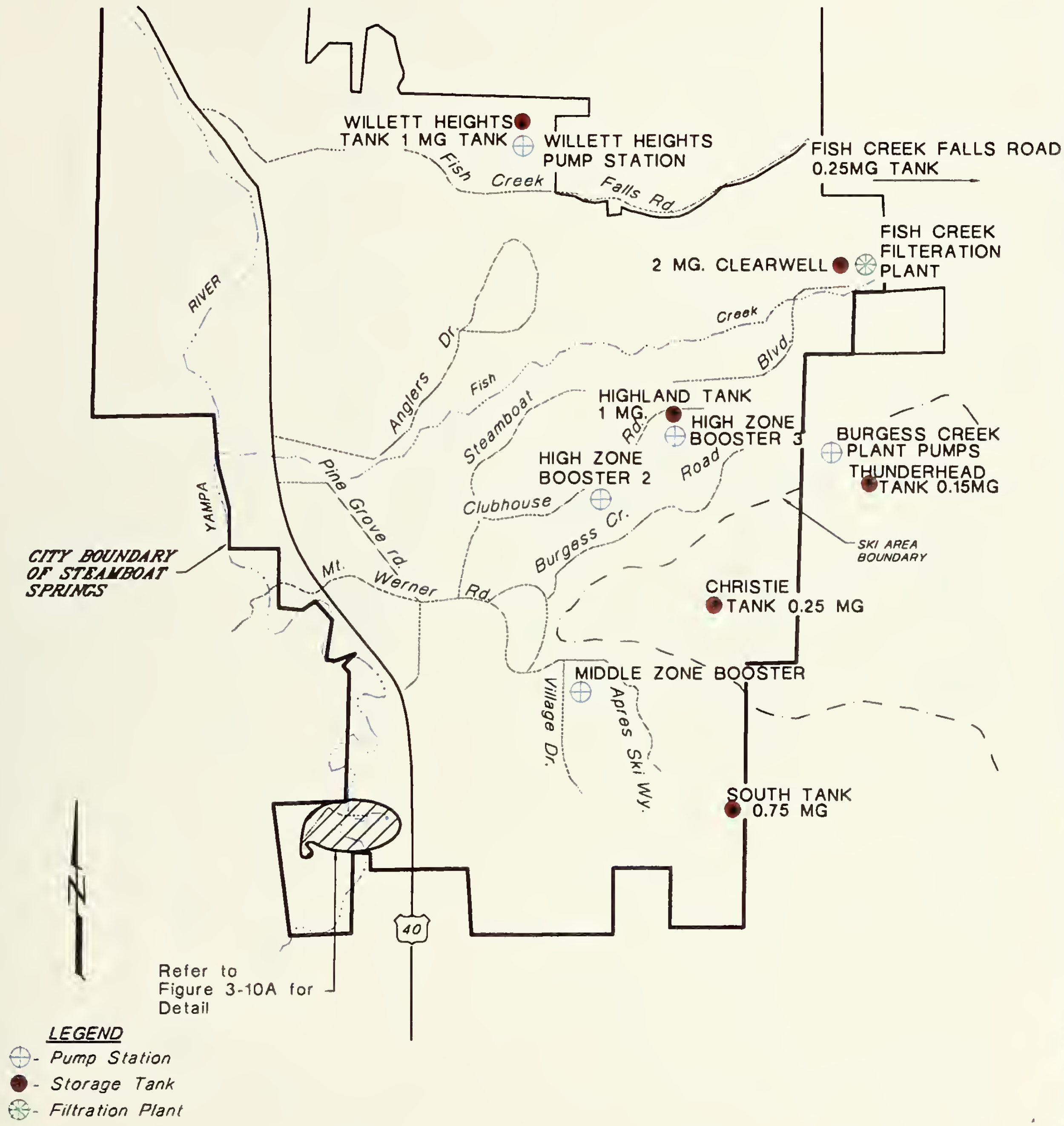
FISH CREEK RESERVOIR EIS

FIGURE 3-9

WATER PLANNING AREA



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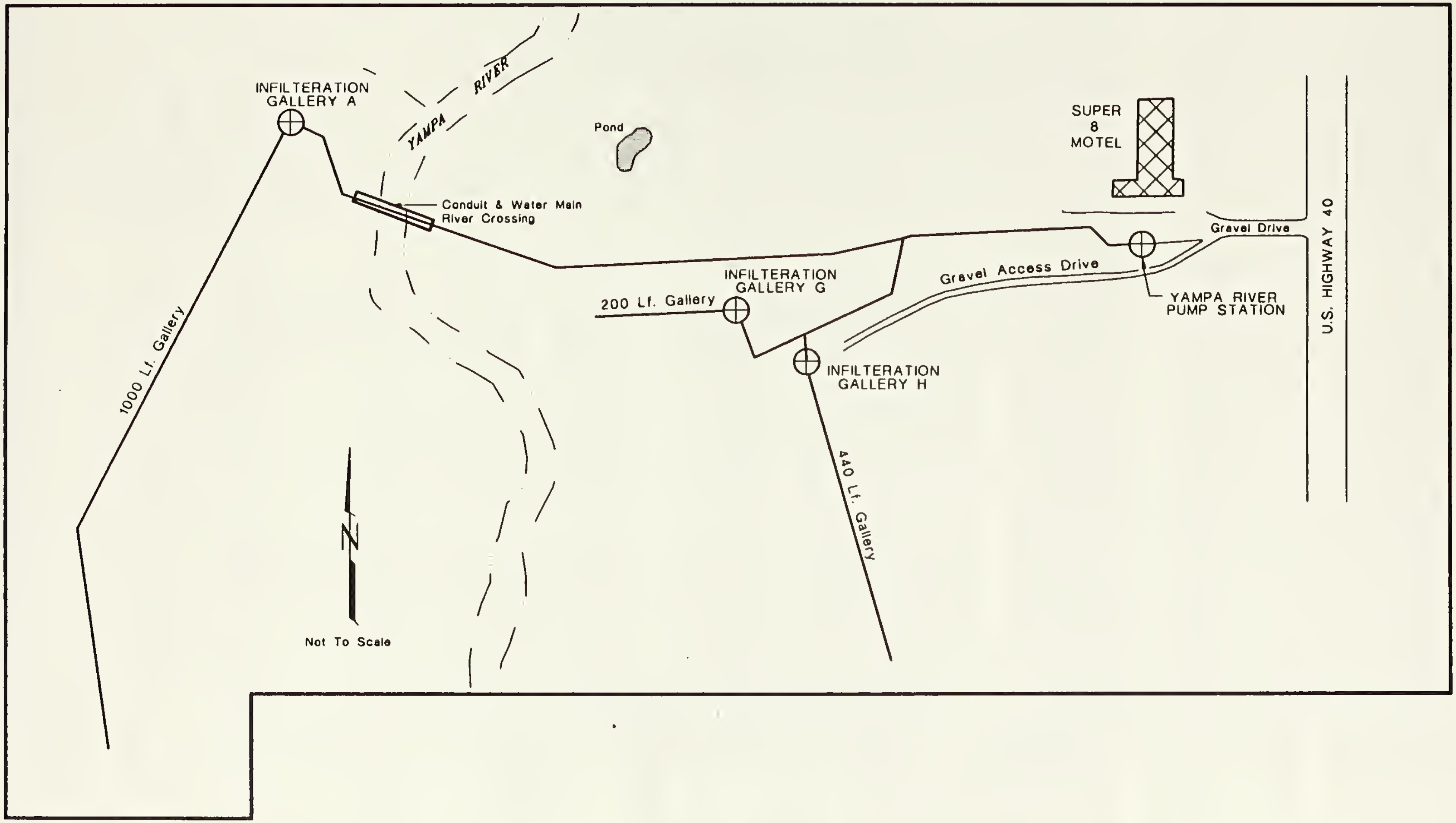
File: FC3EXFA.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-10			WATER SYSTEM FACILITIES



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File: FC3INGA.DWG	Drawn By: T. CLARK	Date: January, 1993

FISH CREEK RESERVOIR EIS

WATER SYSTEM FACILITIES INFILTRATION GALLERIES

FIGURE 3-10A

Mt. Werner's water system consists of a one-third interest (with the City) in the 4.5 MGD Fish Creek Water Filtration Plant; the Yampa River infiltration galleries, capable of providing approximately one MGD of water; four potable water storage tanks with a combined capacity of 2.15 MG; four pumping stations; and approximately 35 miles of water distribution lines.

3.3.5.4 Water System Operations

Although the City and Mt. Werner maintain separate ownership of the water systems as described in the previous section, it is operated primarily as one system. Table 3-9 summarizes the ownership, operation, and maintenance of the water system.

TABLE 3-9
WATER SYSTEM FACILITIES

Facility	Owns	Operates	Maintains
A-DAMS/RESERVOIRS			
Fish Creek Reservoir	C	C	C
Long Lake Reservoir	C	C	C
B-TREATMENT PLANTS			
Fish Creek Filtration Plant	C-2/3 MW-1/3	MW	MW
C-WELL FIELDS			
Well Field A	C	MW	MW
Well Field G	MW	MW	MW
Well Field H	MW	MW	MW
D-DISTRIBUTION SYSTEM			
City	C	C	C
Mt. Werner	MW	MW	MW
E-PUMP STATIONS			
Yampa River Pump Station	C	MW	MW
Willet Heights	C	MW	MW
All Others	MW	MW	MW
F-STORAGE TANKS			
Fish Creek Filtration Plant	C	MW	MW
Willet Heights	C	MW	MW
Fish Creek Falls	C	MW	MW
All Others	MW	MW	MW
C=City MW=Mt. Werner			

3.3.6 Water Demand

3.3.6.1 Historical Water Usage

Water usage data for the City, Mt. Werner, and the two entities combined, tabulated from 1985 (when the Fish Creek Filtration Plant was placed on line) to the present, is presented in Table 3-10.

TABLE 3-10
WATER USAGE 1985 - 1992
MG

MONTH	1985			1986			1987			1988		
	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL
JAN	30.323	37.329	67.652	29.709	35.828	65.537	29.620	39.795	69.415	27.389	33.296	60.685
FEB	30.411	35.815	66.226	27.501	30.989	58.490	26.430	34.864	61.294	24.695	30.226	54.921
MAR	31.752	39.562	71.314	30.231	37.465	67.696	28.311	40.584	68.895	29.530	33.850	63.380
APR	26.747	25.039	51.786	27.621	24.291	51.912	26.376	25.660	52.036	24.357	20.805	45.162
MAY	31.909	24.336	56.245	37.382	23.513	60.895	30.372	24.773	55.145	31.012	22.581	53.593
JUN	59.473	43.711	103.184	59.525	48.900	108.425	51.519	45.362	96.881	60.303	48.116	108.419
JUL	55.342	46.486	101.828	39.972	41.957	81.929	54.146	42.270	96.416	68.354	56.031	124.385
AUG	47.575	47.157	94.732	52.374	47.864	100.238	38.738	31.937	70.675	53.309	50.849	104.158
SEP	32.789	27.685	60.474	30.868	26.987	57.855	36.857	25.770	62.627	37.554	37.342	74.896
OCT	26.628	20.738	47.366	27.119	21.654	48.773	26.685	20.000	46.685	25.562	24.804	50.366
NOV	28.829	20.766	49.595	25.259	22.927	48.186	24.374	18.219	42.593	23.074	24.773	47.847
DEC	30.775	33.027	63.802	28.152	33.702	61.854	27.187	27.382	54.569	24.723	33.122	57.845
ANNUAL TOTAL	432.553	401.651	834.204	415.713	396.078	811.791	400.615	376.616	777.231	429.862	415.794	845.656

TABLE 3-10 (cont'd)
WATER USAGE 1985 - 1992
MG

MONTH	1989			1990			1991			1992		
	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL	CITY	MT. WERNER	TOTAL
JAN	23.566	38.027	61.593	26.334	38.885	65.219	25.511	39.524	65.489	25.603	36.879	62.482
FEB	30.275	36.802	60.077	23.862	34.472	58.334	22.994	35.944	58.938	23.501	32.914	56.415
MAR	26.328	41.279	67.607	25.589	39.524	65.113	25.437	37.962	63.399	24.038	37.861	61.899
APR	24.521	25.856	50.377	20.829	22.658	43.487	22.248	25.503	47.751	22.619	23.367	45.986
MAY	34.874	38.[illegible]27	66.101	26.563	25.286	51.849	21.998	21.992	43.990	30.404	26.754	57.158
JUNE	54.832	49.263	104.095	47.972	45.236	93.208	42.890	40.486	83.376	38.889	31.229	70.118
JUL	63.758	59.920	123.678	46.265	51.636	97.901	52.639	55.774	108.413	44.387	39.823	84.210
AUG	40.693	44.605	85.298	49.037	54.174	103.211	44.864	39.981	84.845	41.698	45.477	87.175
SEP	37.128	35.763	72.891	34.810	34.310	69.120	34.555	31.230	65.785	27.148	29.304	56.452
OCT	26.765	26.550	53.315	32.103	26.862	58.965	26.822	20.779	47.601	24.637	22.954	47.591
NOV	23.905	25.406	49.311	25.871	26.113	51.984	23.158	18.533	41.691	21.290	23.285	44.575
DEC	27.279	33.097	60.376	27.482	33.254	60.736	27.572	27.993	55.565	23.253	29.820	53.073
ANNUAL TOTAL	406.924	447.795	854.719	386.717	432.410	819.127	370.688	396.155	766.843	347.467	379.667	727.134

Total water usage is shown graphically in Figure 3-11. Since 1985, total annual waterusage has been approximately 800 million gallons per year (MG/yr) with about one-half of the usage attributed to the City, and one-half of the usage attributed to Mt. Werner. The greatest amount of water is utilized during the irrigation season (May through September), and the least amount of water is generally utilized between the ski and summer seasons (April, May, October, and November). Although the largest numbers of people are in town during the ski season (December through March), water usage is not as high as during the summer irrigation months.

Monthly water usage for 1991 for the City, Mt. Werner, and the two entities combined is shown graphically in Figure 3-12. While annual usage trends are similar for both the City and Mt. Werner, Mt. Werner tends to utilize more water than the City in the winter months and less water than the City during the summer months. The highest monthly usage for both entities, however, is during the summer months. This data indicates that irrigation impacts water demand to a greater extent than ski season tourism.

Annual water usage, between 1985 and 1991, for the City, Mt. Werner, and the two entities combined is presented in Figure 3-13. While total annual water usage has been about 800 MG/year, since 1988, the annual water usage in Mt. Werner has slightly exceeded the annual usage in the City. This may be due to the fact that more permanent year-round residents have moved into the Mt. Werner district, and subsequently, more summer irrigation is occurring in the Mt. Werner area. Another trend noted in Figure 3-13 is that the total water usage has slightly declined since 1989. This is likely due to one of several factors:

- Increased awareness in the need for conservation
- Installation of water meters (community residents are now aware of their water usage patterns and may gradually be initiating their own water conservation methods)
- Higher than average summer precipitation over the past several years.

Based on this past data, and a permanent population of approximately 7,000, a unit water demand of 330 gallons per capita per day (gpcd) is generally utilized in the service area on an annual average basis. With tourist population factored into the analysis, the actual unit demand is approximately 220 gpcd.

3.3.6.2 Water Demand Projections

Water demand projections between 1990 and 2010 utilizing several permanent population growth scenarios (see Section 3.4.4) and a unit demand of 330 gpcd, are presented in Table 3-11. Figure 3-14 presents water demand projections between 1990 and 2010 for all of the City's projected growth scenarios.

TABLE 3-11 WATER DEMANDS										
Year	Slow Growth Rate[3]				Moderate Growth Rate[4]					
	1.6% Annual Growth Rate (Low Growth)		With West Steamboat[1]		3.2% Annual Growth Rate (Moderate Growth)		With West Steamboat[1]		With West Steamboat and Catamount[2] (High Growth)	
	AF/year	MG/year	AF/year	MG/year	AF/year	MG/year	AF/year	MG/year	AF/year	MG/year
1990	2,403	783	2,588	843	2,403	783	2,588	843	2,588	843
1995	2,601	848	2,601	913	2,813	917	3,029	987	3,584	1,168
2000	2,816	918	3,033	988	3,293	1,073	3,546	1,155	4,421	1,441
2005	3,049	993	3,283	1,070	3,854	1,256	4,151	1,352	4,240	1,707
2010	3,300	1,075	3,555	1,158	4,526	1,475	4,859	1,583	6,160	2,007

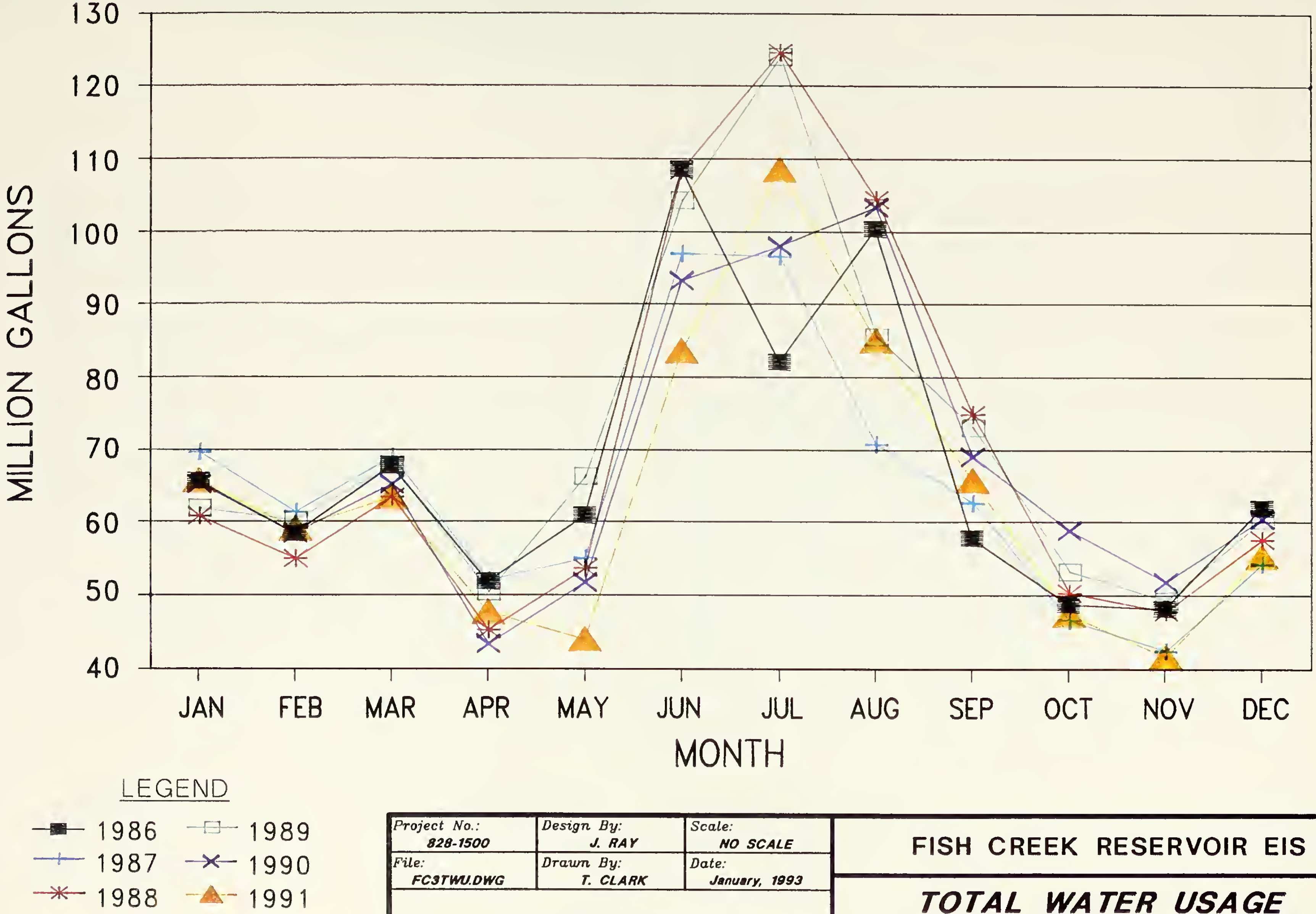
[1]Includes West Steamboat population
[2]Includes West Steamboat population and projected population increase in Steamboat Springs due to potential development of Catamount Area (does not include Catamount population itself)
[3]1.6% Annual Growth Rate
[4]3.2% Annual Growth Rate

3.3.7 Reservoir Storage Requirements

The need for reservoir storage of water is determined by comparing the available water supply during a low flow year with the water demand of the service area. Since the supply and demand fluctuate throughout the year, this analysis is done on a monthly basis.

The water supply available during a low flow year is a function of, not only projected low flows, but also of water rights. The City has a 25 percent share and Mt. Werner a 63 percent share of the senior 8.3 cfs direct flow right on Fish Creek. Since the flow in Fish Creek often drops below 8.3 cfs, the City has the right to 25 percent and Mt. Werner to 63 percent of the available flow at the time. The Fish Creek flow available to the City, Mt. Werner, and the two entities combined during a projected low flow year (Hydrosphere, 1993) is presented in Table 3-12.

TABLE 3-12 AVAILABLE FISH CREEK FLOW (AF)			
Month	City	Mt. Werner	Total Combined
JAN	46	105	162
FEB	42	105	147
MAR	169	878	595
APR	878	2,211	3,089
MAY	3,643	9,181	12,824
JUN	2,291	5,773	8,064
JUL	200	503	433
AUG	123	310	433
SEP	310	262	367
OCT	31	77	108
NOV	45	112	157
DEC	46	116	162



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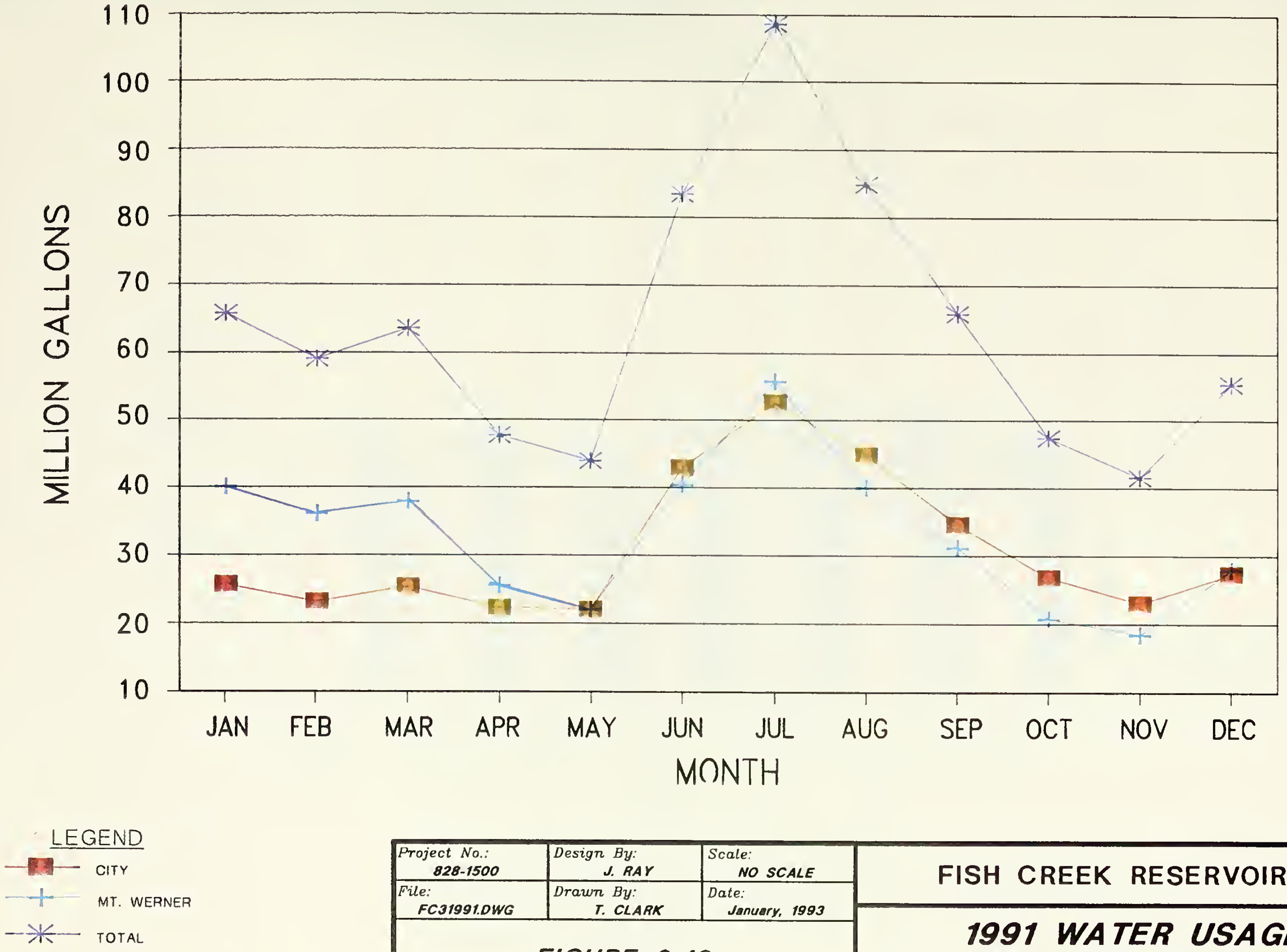
File: FC3TWU.DWG	Drawn By: T. CLARK	Date: January, 1993	

FIGURE 3-11

TOTAL WATER USAGE (CITY AND MT. WERNER)

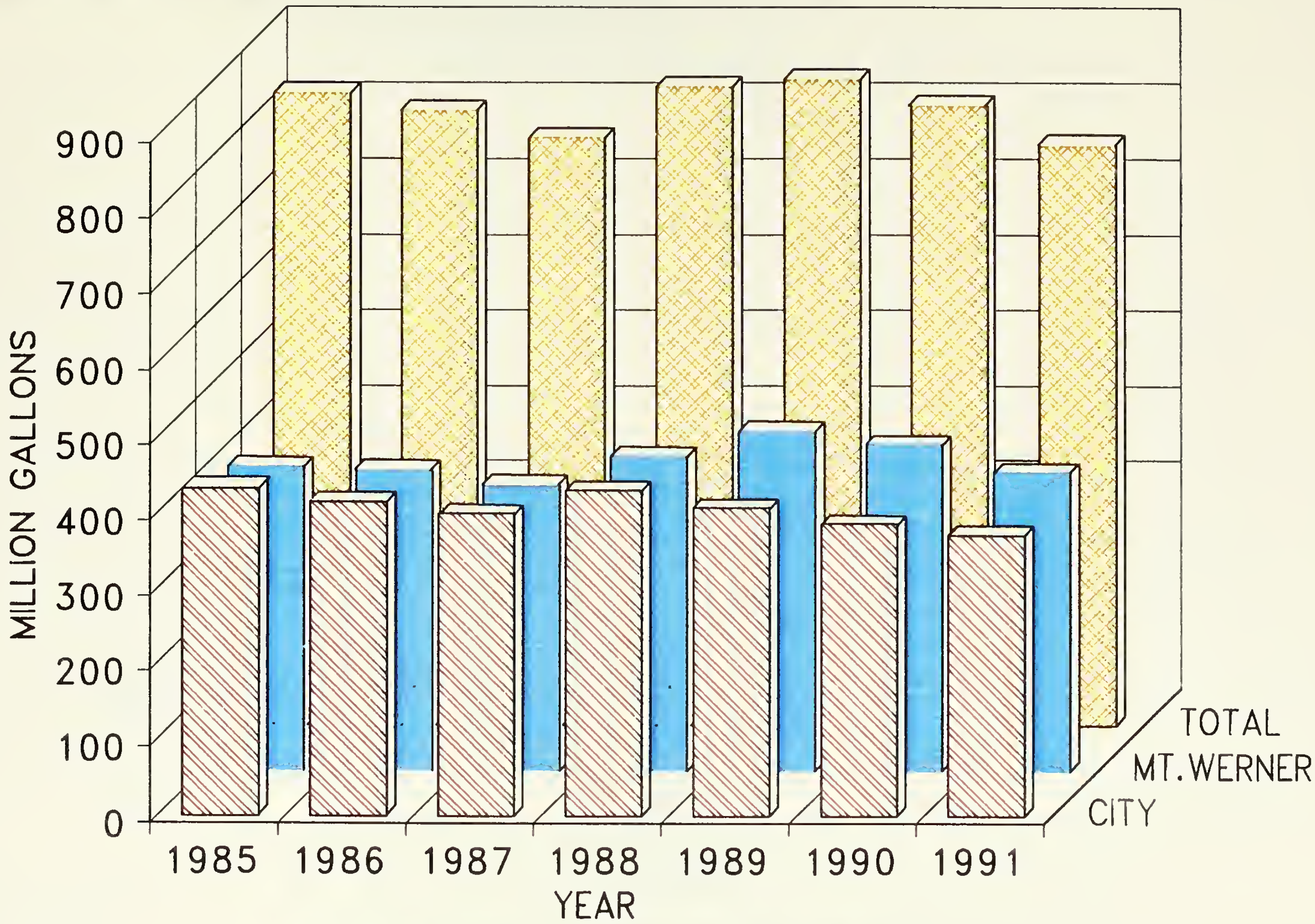


Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE
File: FC31991.DWG	Drawn By: T. CLARK	Date: January, 1993

FIGURE 3-12

FISH CREEK RESERVOIR EIS

1991 WATER USAGE CITY, MT. WERNER AND TOTAL

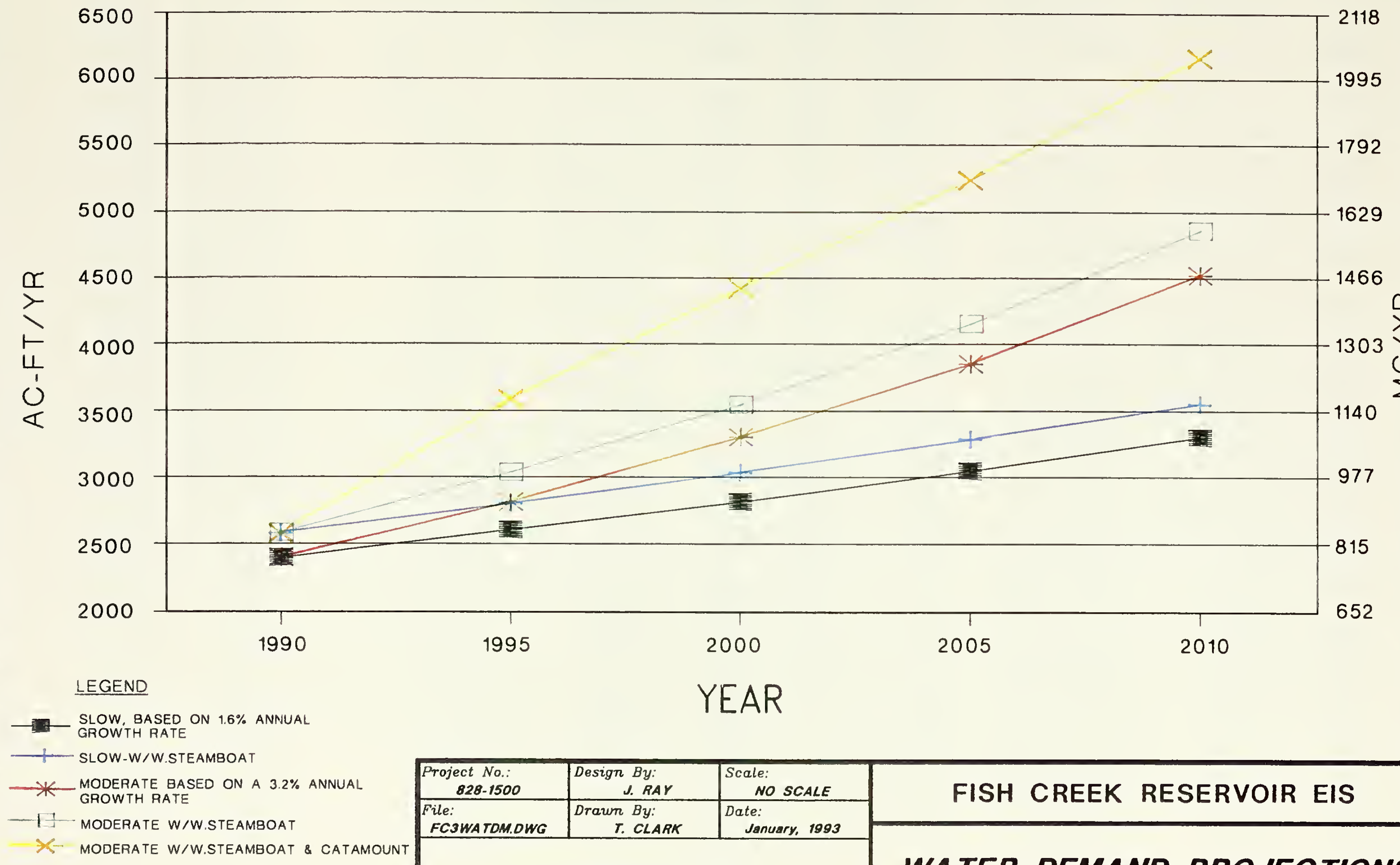


Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE
File: FC3ANWU.DWG	Drawn By: T. CLARK	Date: January, 1993

FISH CREEK RESERVOIR EIS

FIGURE 3-13

ANNUAL WATER USAGE 1985 - 1991



Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC3WATDM.DWG	Drawn By: T. CLARK	Date: January, 1993	

FIGURE 3-14

WATER DEMAND PROJECTIONS

The projected monthly water demands for the City, Mt. Werner, and the two entities combined are displayed in Table 3-13. These demands are based upon the annual projected water demands presented in Table 3-11 and the monthly water usage patterns displayed in Table 3-10.

Water demands presented in Table 3-13 were subtracted from the available Fish Creek Flow presented in Table 3-12 to determine the storage volume required by the City, Mt. Werner, and the two entities combined to meet the projected water demands. Results are summarized in Table 3-14, Reservoir Storage Capacity Requirements To Meet Water Demands.

Additional reservoir storage capacity is required beyond that needed to meet the City's and Mt. Werner's projected water demands. A buffer of approximately 25 percent is required to allow for operational flexibility and the immediate response to changes in demand. The City presently releases water quantities from storage greatly in excess of demands due to the lack of a remote operational control system. Even with the ability to control water release remotely from the reservoir, a sufficient buffer will be required.

Additionally, some storage is required to account for inefficiencies in water delivery from the reservoir to the water treatment plant intake. A 10 percent water loss can be assumed between the reservoir and the intake (Holt, 1992c).

Furthermore, as discussed previously, the City has agreed to release at least 200 AF annually to maintain minimum in-stream flows in the lower segment of Fish Creek.

Total reservoir storage capacity requirements are obtained by adding these additional storage requirements to the values presented in Table 3-14. Table 3-15, Total Reservoir Storage Capacity Requirements, reflect these results.

This analysis does not include minimum pool requirements necessary to maintain a fishery in Fish Creek Reservoir. The Colorado Division of Wildlife (CDOW) is presently determining the appropriate conservation pool volume for Fish Creek Reservoir. Table 3-15 will be adjusted in the Final EIS to reflect the CDOW recommended conservation pool volume.

The analysis also does not include storage projections beyond the year 2010. While dams are often designed with a 50-year planning horizon, future uncertainties within the service area make long range planning very difficult. For this analysis, it is assumed that the extremely wide range of growth scenarios presented by the City in their 20-year projections provides some indication of long-range growth possibilities.

3.3.7.1 City

The City is presently using approximately 350 AF of reservoir storage capacity to meet its water demands (ACZ, 1992b). To meet the future projected demands for the year 2010, a total of 710 AF of storage will be required if the low growth scenario occurs, 1,260 AF if the moderate growth scenario occurs and 2,050 AF if the high growth scenario occurs.

Since the City already has approximately 2,238 AF of storage (1,842 AF in Fish Creek Reservoir and 396 AF in Long Lake) it does not need additional reservoir storage capacity to meet projected 2010 water demands.

TABLE 3-13
FUTURE MONTHLY WATER DEMANDS
(AF)

MONTH	CITY			MT. WERNER			TOTAL COMBINED		
	2010 Low Growth	2010 Moderate Growth	2010 High Growth	2010 Low Growth	2010 Moderate Growth	2010 High Growth	2010 Low Growth	2010 Moderate Growth	2010 High Growth
JAN	112	154	210	152	208	284	264	362	494
FEB	104	143	188	137	188	256	241	331	350
MAR	114	156	213	155	213	290	269	369	503
APR	101	138	188	97	134	182	198	272	380
MAY	124	170	231	101	138	188	225	308	499
JUN	218	299	108	185	254	345	403	553	752
JUL	221	303	413	205	281	382	426	584	795
AUG	190	261	354	137	249	339	372	510	503
SEP	112	195	265	126	172	284	268	367	499
OCT	111	152	207	92	127	173	241	279	380
NOV	101	138	188	91	125	170	192	263	358
DEC	112	154	210	127	174	237	239	328	447
TOTAL	1,650	2,263	3,080	1650	2,263	3,080	3,300	4,526	6,160

TABLE 3-14
RESERVOIR STORAGE CAPACITY REQUIREMENTS TO MEET WATER DEMANDS**
(AF)

Month	CITY			MT. WERNER			TOTAL COMBINED*		
	2010 Low Growth	2010 Moderate Growth	2010 High Growth	2010 Low Growth	2010 Moderate Growth	2010 High Growth	2010 Low Growth	2010 Moderate Growth	2010 High Growth
JAN	66	108	164	36	92	168	102	200	332
FEB	62	103	152	32	83	151	94	184	303
MAR			44						
APR									
MAY									
JUN									
JUL	21	103	213						92
AUG	67	103	231			29		77	260
SEP	37	90	160						332
OCT	80	103	176	15	50	96	95	103	272
NOV	56	83	143		83	96	95	106	201
DEC	66	103	164	11	58	121	77	106	285
TOTAL	455	862	1,447	94	296	623	403	904	1,877

* The total combined storage requirements are equal to the sum of the City and Mt. Werner storage requirements only during those months when both the City and Mt. Werner require storage. During those months when only the City requires storage, if the two entities consolidate, the City can utilize excess Mt. Werner Fish Creek flow prior to utilizing storage capacity.
** Calculated by subtracting water demands (Table 3-13) from direct flow supplied by Fish Creek (Table 3-12)

TABLE 3-15
TOTAL RESERVOIR STORAGE CAPACITY REQUIREMENTS*
(AF)

	CITY	MT. WERNER	TOTAL OPERATING SEPARATELY	TOTAL COMBINED** (CONSOLIDATED)
2010-Low Growth	710	230	940	740
2010-Moderate Growth	1,260	500	1,760	1,420
2010-High Growth	2,050	940	2,990	2,730

* Adjusted for operational constraints and to meet minimum in-stream flows in lower Fish Creek
** The total combined reservoir storage capacity does not equal the sum of the City and Mt. Werner storage requirements for the consolidated district. If the two entities consolidate, the City can utilize excess Mt. Werner stream flow prior to utilizing storage capacity.

In addition, the City has a back-up water supply source in the infiltration galleries (Well Field A). Well Field A, with a sustained yield of approximately 900 gpm, can be utilized to offset peak demands.

3.3.7.2 Mt. Werner

Mt. Werner is presently using approximately 20 AF of the City's reservoir storage capacity to meet its water demands (ACZ, 1992b). It needs 230 AF of storage to meet 2010 low growth demands, 500 AF to meet 2010 moderate growth demands and 940 AF of storage to meet 2010 high growth demands. Since Mt. Werner does not presently have any water storage volume, it must develop storage to meet present and future demands.

Mt. Werner also has a back-up water supply source in the infiltration galleries (Well Fields G and H). The sustained yield of these well fields is approximately 800 gpm.

3.3.7.3 Total Combined Storage Requirements

If the City and Mt. Werner choose to consolidate, the present reservoir storage capacity required to meet their needs is approximately 140 AF. To meet future (2010) demands, 740 AF of storage is required for the low growth scenario; 1,420 AF for the moderate growth scenario; and 2,730 AF for the high growth scenario. Although the City already has approximately 2,238 AF of reservoir storage capacity, additional storage (492 AF) would be required if the two entities consolidate.

Additionally, the infiltration galleries (Well Fields A, G, and H) would provide a back-up water supply with a sustained yield of approximately 1500 gpm to the consolidated water provider.

3.3.8 Other Water Users

Due to the lack of remote operational control of the Fish Creek Reservoir outlet valve, the City releases substantially more water from storage than is required to meet its own demand. The additional storage water released is intended to augment in-stream flows and maintain the Colorado Water Conservation Board's 2 cfs minimum in-stream flow right (see Section 3.3.3). This water, however, is sometimes utilized during the low flow months of August and September by less senior downstream users.

A recent analysis by the Colorado Division of Water Resources (Holt, 1992d) indicates that released storage has been diverted by several users including:

- Hoyle & Knight Ditch
- Sheraton Golf Course
- Albert A. Mann Ditch
- Alma Baer Ditch

It is estimated that usage may be as high as 100 AF per month during low flow periods.

More water has historically been released from Fish Creek Reservoir and Long Lake than is necessary to meet the demands of the City. As discussed previously, approximately 20 AF of storage water is utilized annually by Mt. Werner. Water used by downstream diverters and increased in-stream flows account for the additional storage water released.

3.3.9 Water Conservation Programs

At this time, neither Mt. Werner nor the City have formal water conservation plans. However, in order to comply with local and state law and in an effort to encourage future conservation, both districts are presently involved in various programs aimed at conserving water, as discussed below.

3.3.9.1 City of Steamboat Springs

The City is considering or is in the process of implementing the following conservation measures.

Metering/Rate Structuring - In order to delay the need to increase the capacity of treatment facilities and in accordance with Colorado's Water Metering Act of 1990, the installation of water meters in both the residential and commercial sectors of the City was completed in 1990, and meter based billing is expected to begin in early 1993. Although the City still uses a flat rate structure, data is being obtained from water meters in order to determine the rate structures that will be implemented in 1993. According to the City, residents will face an inclining block rate structure that will be initiated in phases over a three-year period. During the first three years of implementation, service charges will decrease annually while volume charges per 1,000 gallons will increase annually. The advantage of this phased approach is that consumers can gradually implement different methods of conservation as they get accustomed to the rate structure. Commercial consumers, on the other hand, will face a declining block rate structure and will also be subject to a basic service charge.

System Maintenance - The City has recently begun replacing all of its main water lines. The program, which began five years ago, involves the replacement of approximately 40 miles of water pipes over a 30-year period. It is estimated that the entire system will be replaced by the year 2020. Although the City has no formal leak detection program included with the maintenance being done, the replacement of the water lines will reduce leakage, and the installation of meters will increase the City's ability to determine the amount of water being lost to leaks.

Irrigation Restrictions - Lawn watering is restricted between the hours of 10:00 AM and 5:00 PM, but compliance is strictly voluntary as no enforcement of this regulation exists. The *Steamboat Today* publishes irrigation requirements according to local precipitation patterns, and prescribes different homes to water on different days (according to address). Again, compliance with these guidelines is voluntary.

Raw Water Use - Raw, untreated water is currently taken from the Yampa River and used for snow-making at the Howelsen Hill Ski Area. The use of raw water, although not necessarily a conservation technique, helps to reduce the demand for potable water and thus results in treatment cost savings.

Xeriscape Grant - The City of Steamboat Springs has received a $19,000 grant from the Colorado State Office of Water Conservation (COWC) in order to partially fund the design and construction of a high-altitude, xeriscape demonstration at Howelsen Hill Park. Intended to introduce the community to the idea of xeriscaping, the demonstration will compare the water use, maintenance, and visual appearance of a 'xeriscape' to that of a 'normal' landscape. In addition, a guide to water efficient landscapes in Colorado mountain communities will be developed. The demonstration is planned for the summer of 1993.

Plumbing Retrofit Grant - The City of Steamboat Springs has been selected as the test site for a study on the cost effectiveness of retrofitting tourist-oriented lodging complexes. The study will be

conducted by the Northwest Colorado Council of Governments and will be funded by a $20,425 grant issued by the COWC. The study will analyze the water use patterns of tourists and will compare the water demand in retrofitted condominiums to demand in non-retrofitted condominiums. From the data obtained, the cost effectiveness of retrofitting large condominiums, including the potential savings that can result, will be determined. The findings of this study will be made available to all resort communities.

Pressure Reduction Valves - The City requires the use of pressure reducing valves (PRVs) in order to ensure that the water pressure in its system does not exceed 60 pounds per square inch (psi). PRVs are installed, not only on main lines, but at each point of use in the system. The PRVs protect the system from fluctuations in water pressure and, in turn, increase the efficiency of the water system. Water pressure has direct effects on the flow rates of common plumbing fixtures and should thus be maintained at 50-60 psi for maximum efficiency.

3.3.9.2 Mt. Werner Water and Sanitation District

Mt. Werner is considering or is in the process of implementing the following conservation measures:

Metering/Rate Structuring - The installation of water meters in the residential and commercial sectors of the district was completed in 1991, and meter-based billing began in January 1993. Consumers are charged a base rate that includes a service charge and receive 10 cubic meters (approximately 2,640 gallons) of water per month with the base rate. Water usage above this monthly allotment is billed on a per cubic meter basis. This rate structure is used for both residential and commercial consumers.

Lawn Irrigation - Like the City, lawn watering in Mt. Werner is restricted between 10:00 AM and 5:00 PM and information on efficient irrigation is provided in the *Steamboat Today*.

New Construction Ordinance - According to Mt. Werner, its Rules and Regulations (April 1991) require all new buildings constructed in the Mt. Werner Water District to have water-efficient plumbing fixtures. These include low flow toilets, low flow showerheads, and faucet aerators.

Pressure Reduction Valves - Mt. Werner also requires the use of pressure reducing valves (PRVs) in order to ensure that the water pressure in its system does not exceed 60 pounds per square inch (psi). PRVs are installed, not only on main lines, but at each point of use in the system. The PRVs protect the system from fluctuations in water pressure and, in turn, increase the efficiency of the water system.

Raw Water Use - Like the City, Mt. Werner promotes the use of raw water, in some circumstances, to reduce demand for treated water. The Steamboat Ski Area uses water from the Yampa River to make snow and the Sheraton Golf Course uses water from Fish Creek for irrigation.

Plumbing Retrofit Grant - The Mt. Werner Water and Sanitation District is assisting the City of Steamboat Springs with the study on the cost effectiveness of retrofitting condominiums with low flow devices.

3.4 SOCIOECONOMICS

3.4.1 Introduction

This section addresses the socioeconomic climate which may be affected by the Proposed Action and/or the alternatives to the Proposed Action. It discusses the social atmosphere of the community, general social concerns, demographics, the general relationship between water availability and community growth, and water utility financing. Further details on the socioeconomic resource are found in the *Socioeconomics Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992c).

3.4.2 Social Atmosphere

The social atmosphere in Steamboat Springs is rooted in its ranching and agricultural heritage. The current small-town lifestyle that the residents of Steamboat Springs enjoy reflects the area's history of economic dependence on agriculture and mining. It is apparent that the social context of the town has changed considerably with the development of the Steamboat Ski Resort, and the subsequent transition from an agricultural based economy to a primarily tourist-driven economy. However, a recent survey (Krannich, 1990) shows that most residents of Steamboat Springs are still pleased with the overall quality of life. Although the town has seen a dramatic shift in the economic base and has grown considerably over the past two decades, the atmosphere in Steamboat Springs has remained friendly, and has continued to provide a "small-town" feel to the area.

The satisfaction with the quality of life in Steamboat Springs is associated with a number of factors. Although Steamboat has grown to be one of the larger, and most popular destination ski resorts in Colorado, many residents have the desire to preserve the customs and culture of the town's agricultural history. In protecting these traditions, there is a strong "sense of community" among the residents of the town. These attributes set Steamboat apart from the typical ski town, making it a unique place to live and to visit. Residents and tourists alike, have come to appreciate the friendly atmosphere, the availability of improved public services, and the recreational opportunities provided in Steamboat.

3.4.3 Social Concerns

Many sociological surveys have been conducted recently in order to identify concerns that residents may have about the community. It is apparent from these surveys that the majority of concerns among the community revolve around the issue of growth and related impacts. Although the atmosphere in Steamboat Springs can be characterized by a sense of unity, surveys such as Krannich's (1990) have shown that residents have various and wide-ranging opinions about the direction in which the community is moving.

As a result of proposals to build new golf courses, fast-food franchises, and a new ski resort seven miles south of Steamboat at Lake Catamount, tension between growth advocates and those less supportive of growth has become more evident in recent years. Surveys have shown that residents agree that there is a sensitive relationship between "quality of life" attributes and growth and development patterns, but that they disagree on the nature of this relationship (Krannich, 1990). Many believe that tourist-related growth is beneficial because it enhances the economy. Others, however, perceive this type of growth to be deteriorating the traditional lifestyle of the Yampa Valley.

Many residents are concerned about community growth which encourages more tourism because this type of development will presumably augment an already present problem. With a tourist-oriented economy such as Steamboat's, there is an inherent, seasonal instability of employment and business activity. There is a considerable difference between the business that the ski season and the summer season provide. In addition, the two months after ski season and the two months prior to ski season (the off-seasons), see very little tourism (with the exception of hunting season in the Fall) and thus provide very little business activity. In the last five years, both the City and the Steamboat Springs Chamber Resort Association have increased their summer marketing of Steamboat in an effort to provide a more stable, year-round economy. However, economic indicators, such as average sales tax revenue and unemployment rates, reveal that there continues to be very large fluctuations in the yearly business activity of Steamboat, as shown in Figure 3-15.

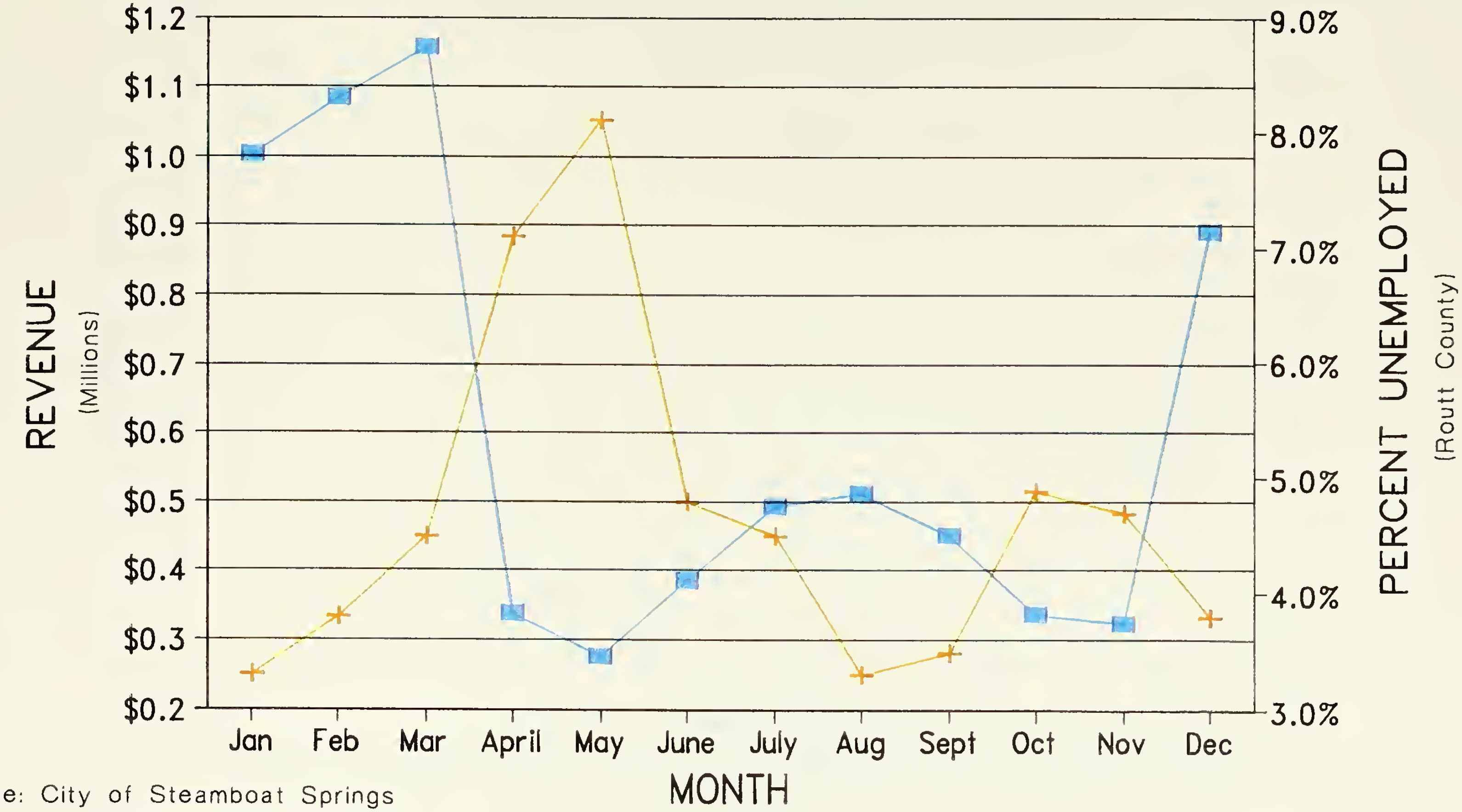
Between 1988 and 1991, a period that saw considerable growth in tourism, property values and the average sale price of housing units in Steamboat Springs increased dramatically. During this period, the average sale price of vacant land (housing lots) increased by nearly 34 percent, and the average sale price of a residential home increased by nearly 30 percent (Steamboat Chamber Resort Association, 1992). During the same period though, the average annual wage of all employees in Routt County increased by only 6 percent (Colorado Department of Labor and Employment, 1992). Many are concerned that the moderate to low income residents, and particularly the residents on fixed incomes, will be unable to keep up with the impacts of the increased costs of living in the community.

Furthermore, there is a lack of new affordable housing being built. Figure 3-16, New Building Permits Issued in Steamboat Springs, depicts a recent surge in construction. Rosall Remmen and Cares (1990) report, however, that the bulk of this construction has been in the single-family residential and in the retail-commercial marketplace, and has not been oriented toward providing affordable housing. During the first seven months of 1992, Routt County issued 85 single-family-home building permits, 25 more than the comparable period in 1991 and twice as many as in 1989 (Rocky Mountain News, 1992).

Many residents are also concerned about impacts to the physical setting of the town. Physical attributes such as traffic levels, air quality, and open space are also important to the quality of life in Steamboat Springs, and all are affected by growth and development. The physical attributes of Steamboat, including the surrounding natural environment, are valuable characteristics of the town. There is considerable concern among many residents that Steamboat is growing at a pace in which important physical characteristics are being sacrificed. A majority of people living in Steamboat feel it is important to protect the integrity of the physical environment (Krannich, 1990).

Many residents are also concerned that rapid growth could result in a reduction in the social services presently enjoyed by the community. The public services in Steamboat Springs were cited by residents as one of the more appealing characteristics of the town (Krannich, 1990). The availability and the quality of social services provided in Steamboat have helped to make the town a popular place to raise a family. The community desires to preserve the quality of its social services including schools, child care, health care, fire protection, and law enforcement.

It is clear that the social environment in Steamboat Springs is characterized by some degree of factionalism, the majority of which is centered on growth-related issues. Surveys such as Krannich's (1990), have documented these differences in opinion, and have shown that there is a need for better growth management in order to protect the quality of life attributes that the residents of Steamboat Springs value the most. A recent newspaper article has emphasized the need for "balance" between



Source: City of Steamboat Springs Sales/Accomodations Tax Revenue by Month. 1988-1991

Colorado Department of Labor & Employment. Local Area Unemployment Statistics. 1988-1991

LEGEND

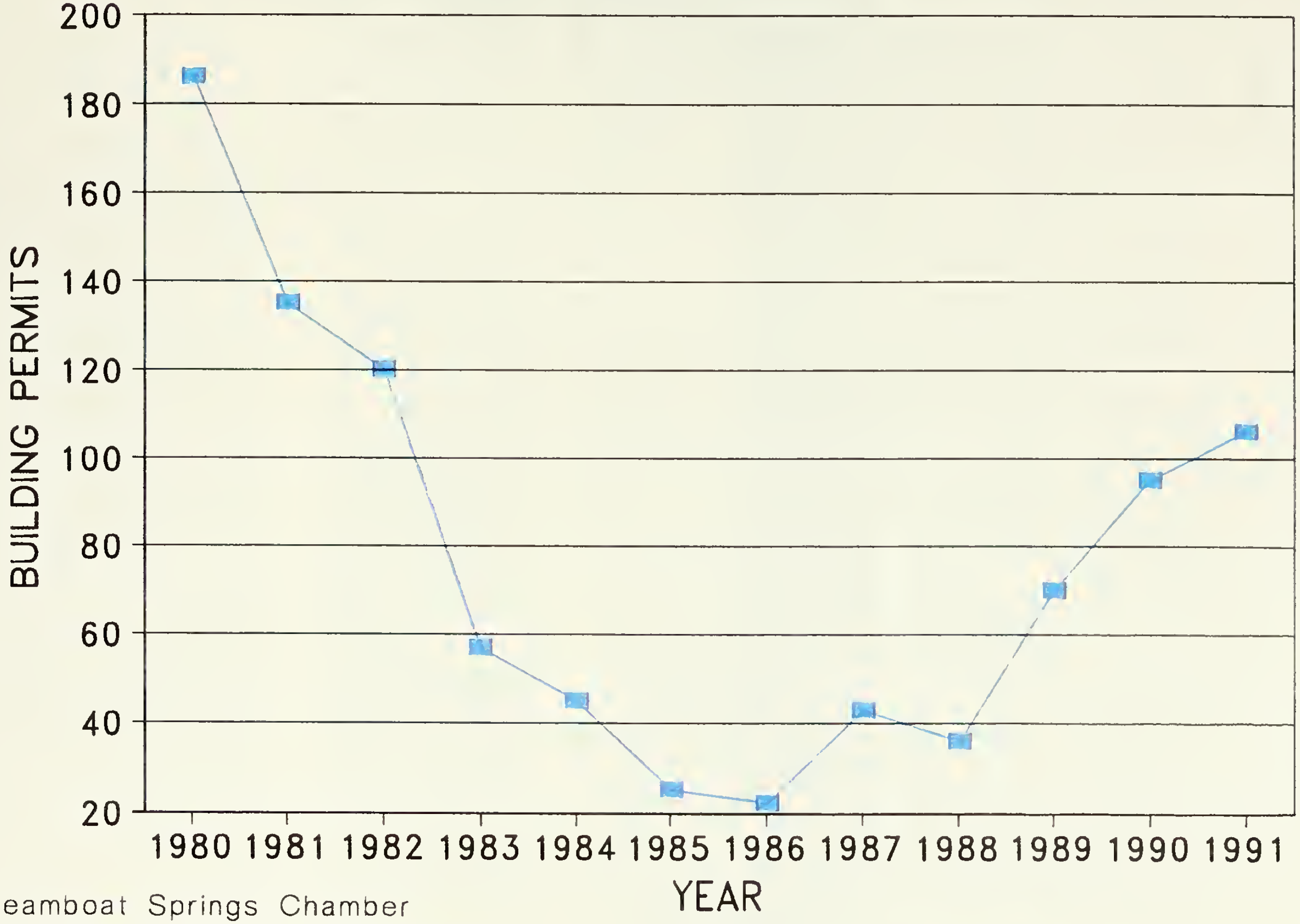
- SALES TAX REVENUE
- UNEMPLOYMENT RATE

Project No.: 828-1500	*Design By:* L. LABOVITCH	*Scale:* NO SCALE
File: FC3RVR91.DWG	*Drawn By:* T. CLARK	*Date:* January, 1993

FIGURE 3-15

FISH CREEK RESERVOIR EIS

SALES TAX REVENUE VS UNEMPLOMENT RATE 1991



Source: Steamboat Springs Chamber Resort Association "Steamboat Springs at a Glance." 1992

Project No.: 828-1500	Design By: L. LABOVITCH	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC3BP.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-16			NEW BUILDING PERMITS ISSUED STEAMBOAT SPRINGS

the economy and the environment. Residents of Steamboat agree that there are ways to direct growth without destroying the resources that originally brought people to the area (Rocky Mountain News, 1992). The attitudes of many residents reflect concern that the town of Steamboat is becoming less "livable," and is losing its western ambiance. The majority of residents, however, are satisfied with the quality of life Steamboat currently provides, but many feel that present growth patterns are threatening the town's lifestyle and could eventually displace entirely the true heritage of the area.

3.4.4 Demographics

Table 3-16 presents the population levels for Routt County and for Steamboat Springs over the last twenty years. Today, Steamboat accounts for nearly half of the total population in Routt County. Since 1970, the population has more than doubled. Growth rates increased dramatically with the rise in local energy development during the 70's, decreased in the early 80's as the energy market declined, and have since been increasing once again due to factors such as increased marketing, and the expansion and rising popularity of the Steamboat Ski Area. Steamboat's average annual growth rate was approximately 8 percent from 1970 to 1980, but dropped to 3.4 percent from 1980 to 1986 (USDA Forest Service, 1990). Today, there are approximately 7,000 permanent residents in Steamboat Springs. City population between 1970 and 1990 is shown graphically in Figure 3-17.

TABLE 3-16
POPULATION

LOCATION	1970	1980	1990
Routt County	6,592	13,404	14,088
Steamboat Springs	2,340	5,098	6,695

(Colorado Department of Local Affairs. 1990 Census.)

Future growth rates in Steamboat Springs will depend largely on tourism, future planning decisions, and on the development of a sound growth management plan for the city. As discussed previously, a majority of Steamboat residents are concerned about future growth patterns, and feel there is a need for a well-defined growth plan (Krannich, 1990). It is likely that the decision to build a new ski area at Lake Catamount will change the tone of future growth in the Yampa Valley, as the Lake Catamount Final EIS projects dramatic population increases associated with the approval and development of this project.

Both permanent and peak season population projections for the next twenty years are presented in Table 3-17, and shown graphically in Figures 3-18 and 3-19 (City of Steamboat Springs, 1988). These projections depict several growth scenarios and include the population of West Steamboat and the projected population increase in Steamboat Springs due to the potential development of the Lake Catamount area (does not include the population of Lake Catamount itself). It is projected that the permanent population of Steamboat Springs could reach approximately 17,000 by the year 2010 if Lake Catamount is developed. Furthermore, with the addition of West Steamboat and the development of Lake Catamount, it is estimated that the peak season population (which includes tourists) in the City of Steamboat Springs could reach 42,000 people by the year 2010.

TABLE 3-17
CITY OF STEAMBOAT SPRINGS POPULATION FORECAST

PERMANENT POPULATION:

Year	Slow Growth Rate[3]:		Moderate Growth Rate[4]:		
	1.6% Annual Growth (Low Growth)	With West Steamboat[1]	3.2% Annual Growth (Moderate Growth)	With West Steamboat[1]	With West Steamboat and Catamount[2] (High Growth)
1990	6,500	7,000	6,500	7,000	7,000
1995	7,618	7,578	7,609	8,194	9,694
2000	7,618	8,204	8,907	9,592	11,960
2005	8,247	8,882	10,426	11,228	14,175
2010	8,928	9,616	12,242	13,143	26,000

PEAK SEASON POPULATION:

Year	With Slow Growth Rate:	With Moderate Growth Rate:		
	With West Steamboat[1]	3.2% Annual Growth	With West Steamboat[1]	With West Steamboat and Catamount[2]
1990	25,500	26,000	26,000	26,000
1995	30,037	30,570	31,194	32,194
2000	30,618	31,204	32,592	34,592
2005	31,247	31,882	34,228	38,228
2010	31,928	32,616	36,143	42,143

Notes: [1]Includes West Steamboat population
[2]Includes West Steamboat population and projected population increase in Steamboat Springs due to potential development of Catamount Area (does not include Catamount population itself)
[3]1.6% Annual Growth Rate
[4]3.2% Annual Growth Rate

(City of Steamboat Springs, 1989)

3.4.5 Water Availability and Community Growth

In order to better understand the relationship between water availability and community growth, a survey of 20 small water districts in the western United States was conducted (see Appendix C). For the communities surveyed, water presently is not the driving force in either projecting or preventing growth. Rather, the availability of water enables natural growth patterns within a community to occur. This is especially true for Colorado communities, such as Steamboat Springs, where available water supplies are located downstream from the headwaters of major streams and rivers. In general, a water utility attempts to plan for future growth by making certain that sufficient water sources are available to meet the demands of the community. Most utilities

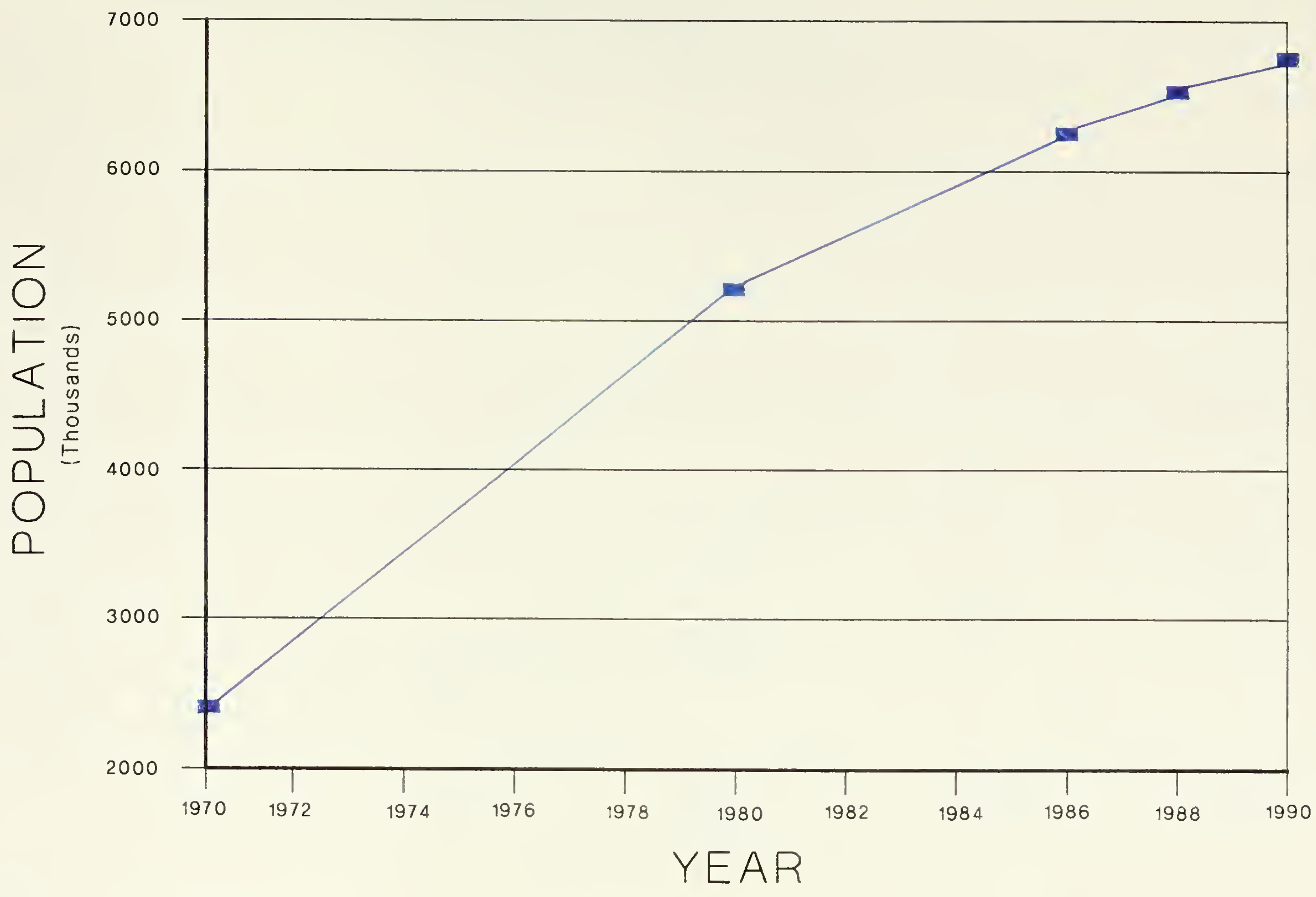


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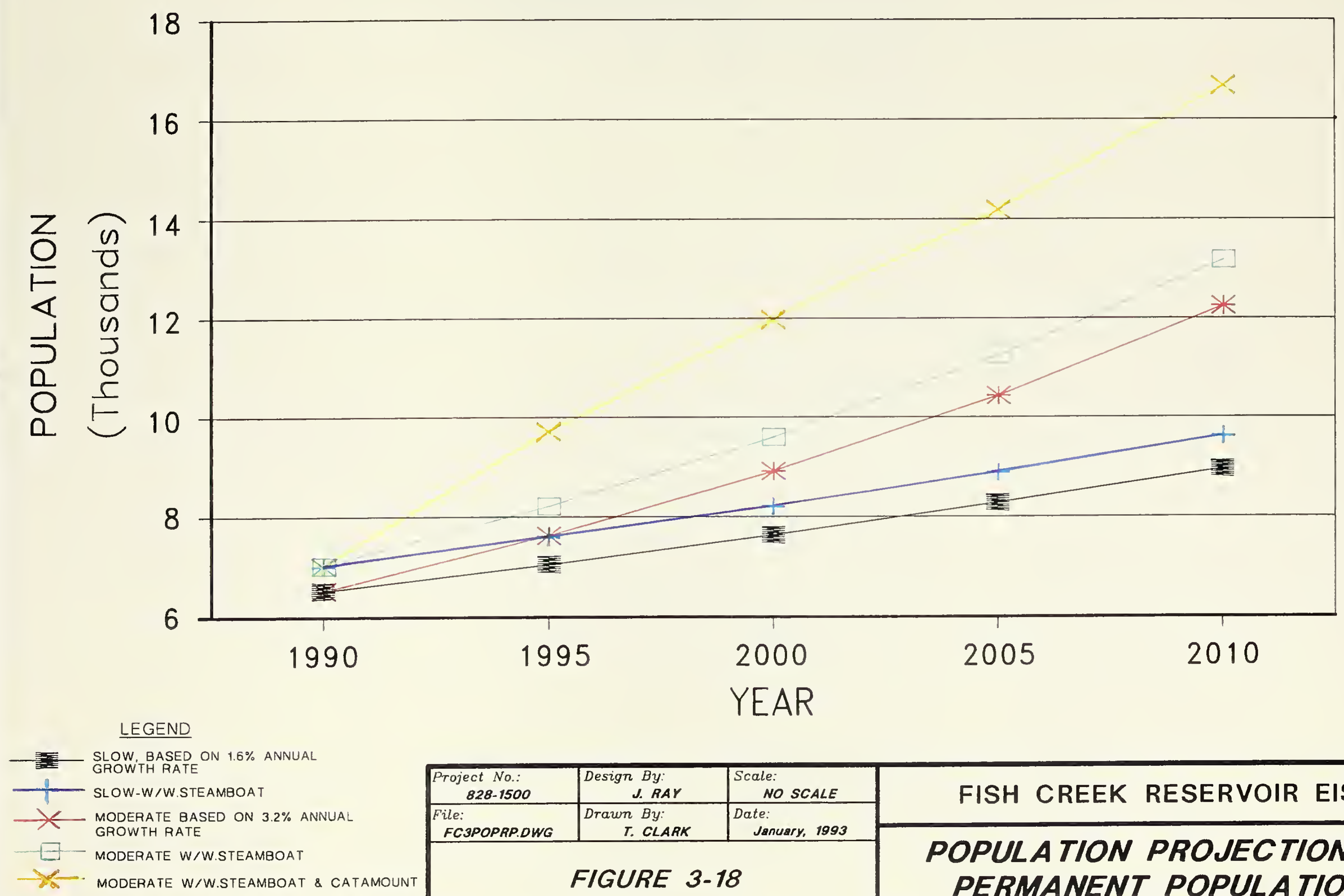
FIGURE 3-17

FISH CREEK RESERVOIR EIS

STEAMBOAT SPRINGS POPULATION



Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
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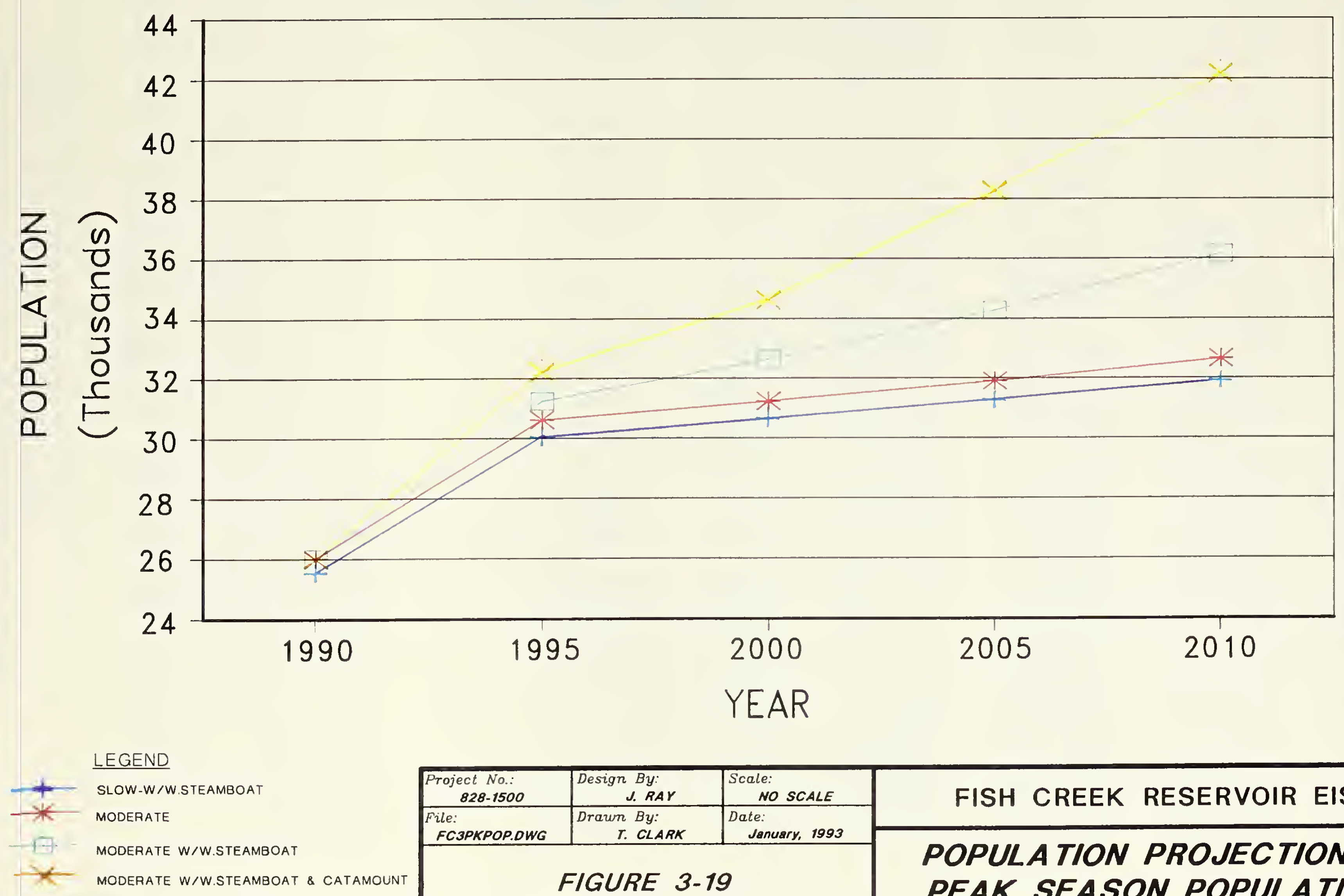
FIGURE 3-18

POPULATION PROJECTIONS PERMANENT POPULATION



Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC3PKPOP.DWG	Drawn By: T. CLARK	Date: January, 1993	POPULATION PROJECTIONS PEAK SEASON POPULATION

FIGURE 3-19

prepare 20 and/or 50 year master plans which enable them to define water needs well into the future and develop appropriate water supplies. With water needs defined, the utility is able to plan for capital improvement projects associated with water supply, treatment, and distribution.

In the event that water supplies become limiting, the lack of water could prevent further growth and development within a community. Taos, New Mexico, is an example of a community with growth restrictions, partially caused by the lack of sufficient water supplies. In desirable tourist communities, such growth restrictions could result in increases in the cost of living and subsequent changes in the demographics of a community.

Historically, water availability in Steamboat Springs has neither promoted nor prevented growth within the community. Rather, other factors such as the ranching and agricultural heritage, small-town lifestyle, physical beauty, quality of life, recreational opportunities, ski industry and tourist aspects of the community have primarily been responsible for growth and development within the area.

Historically, the City and Mt. Werner have obtained water rights and have developed water projects to meet their present and future water demands, as discussed in detail in the *Water Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992b). Approximately 2,238 AF of water storage has been available for the past twenty years. During this same 20-year period, growth in the community has proceeded independently of water supply.

The population has shown a relatively dramatic, boom-bust cycle, as shown in Figure 3-17, with population increasing during the energy development period, decreasing as the energy markets declined, and rising again with the expansion and development of the Steamboat Ski Area (Forest Service, 1990).

The role of water in the growth and development of Steamboat Springs has been minimized since the City and Mt. Werner water utilities have anticipated, and planned for, the future needs of the community. Since sufficient water supplies have historically been available, water has neither promoted, nor prevented, growth in Steamboat Springs. The availability of water, however, has enabled growth to occur.

3.4.6 Water Utility Financing

3.4.6.1 City

The City, through its Public Works Department Utility Division, provides water and sewer services within the City service area (which excludes the area served by Mt. Werner). The City and Mt. Werner water service areas are shown in Figure 3-9. The existing water and sewer systems have been developed and constructed over the years in a continuing effort to meet rising demands and improve services to the City's customers. Costs of operating, maintaining, and financing system improvements are met primarily from the revenue derived from rates and fees to users (B&V, 1988).

In its 1992 budget (City of Steamboat Springs, 1991), the Utility Systems Division established seven goals and objectives pertaining to the water system. These goals include the following:

- Actively promote water conservation
- Establish elevational limit on water service area
- Improve reliability of water distribution system
- Insure that a safe, closed water distribution system is maintained

- Implement metered rate billing system
- Protect City water rights
- Operate and maintain safe reservoirs

The City is actively pursuing these goals and objectives. It has received two grants to study water conservation; has recently completed (1992) the construction of the interconnect system to Mt. Werner and the well fields; and is in the process of implementing a metered rate billing system. The City has recently informed water users of the proposed billing rate structure and has invited them to comment before City Council. The letter from the City to utility customers, including the proposed rate structure, is included in Appendix H.

The City's water fund is an enterprise fund. The water utility, therefore, is financed and operated in a manner similar to a private business enterprise. Services provided by the water fund are intended by City Council to be predominantly self-supporting through user charges (City of Steamboat Springs, 1991).

User charges in the form of monthly customer billings and tap fees are the major sources of revenue to the water fund. Additional revenue sources include property and sales tax (debt service subsidy) revenues (B&V, 1988).

Major expenditures include debt service for prior water distribution and treatment plant capital improvements; personnel costs; and capital, operation, and maintenance costs associated with the supply, treatment, and transmission of water.

Due to the recent passage of Amendment 1, the tax limitation amendment, the 1993 City budget is currently under review. Since Amendment 1 limits the City's subsidy to enterprise funds to 10%, the 1993 water fund budget is being re-evaluated (Today, 1992).

3.4.6.2 Mt. Werner

The Mt. Werner Water and Sanitation District was created in 1967 to provide water and sewer services to the developing ski area. Its primary water supply is from Fish Creek and its secondary source is from the well fields, adjacent to the Yampa River. The Mt. Werner district is almost entirely within the city limits of Steamboat Springs and furnishes potable water from the filtration plant, which is jointly owned by the City and Mt. Werner and managed by Mt. Werner (Fetcher, 1992).

Mt. Werner is governed by an elected Board of five individuals who must be residents or property owners within the Mt. Werner district. As a quasi-municipal subdivision of the State of Colorado under the special district law, it is empowered to levy taxes on property owners within the district. Beginning with an initial mill levy of 15 in 1967, it has a present mill levy of zero (Fetcher, 1992).

In order to encourage conservation and to comply with Colorado law, Mt. Werner has changed from a flat rate water charge to a metered rate water charge. While making this conversion, Mt. Werner has also raised its rates. A copy of the letter to Mt. Werner customers explaining the 1993 rate change is presented in Appendix H.

As with the City, the main sources of revenue for Mt. Werner include user fees in the form of customer billings and tap fees. Additional sources of revenue include water revenue from the City (for the City's share of treatment costs) and a tax rebate from the City. The tax rebate is for property taxes levied against Mt. Werner residents for the City's share of the water filtration plant.

The City owns approximately two-thirds of the filtration plant that was paid for by a bond issue. To repay the bond, a mill levy was assessed on the entire City, including residents of the Mt. Werner district. Consequently, Mt. Werner receives a tax rebate annually from the City, and will continue to do so until the year 1999, at which time, the mill levy and rebate will be discontinued.

Major expenditures for Mt. Werner include personnel, capital, operation, and maintenance costs associated with the supply, treatment, and transmission of water.

3.4.6.3 Financial Arrangement for Proposed Reservoir Expansion

The preliminary cost estimate for the proposed Fish Creek Reservoir expansion and the associated improvements is six million dollars. A financial arrangement between the City and Mt. Werner has been reached in which the two entities would share the project costs. The City's share would be approximately 25%, and Mt. Werner's share would be approximately 75% of the total project costs. The water storage capacity received by each entity would be proportional to the share of the project for which each entity pays. In regard to storage capacity, the City would receive approximately 570 AF of additional storage and Mt. Werner would receive approximately 1,710 AF of extra storage. The City Council Resolution, dated August 25, 1992, authorizing the City of Steamboat Springs to share in the cost of the proposed reservoir expansion is presented in Appendix I. This resolution was conditioned upon Forest Service approval of the Permit Application.

In order to secure financing for the proposed project, Mt. Werner obtained a loan agreement from the Colorado Water Resources and Power Development Authority (Authority) on September 23, 1992 in the amount of $4,630,000 at an annual interest rate of 6.29 percent. Mt. Werner would utilize its reserves to finance the remainder of the $6,000,000 project, if the project was approved.

The loan would be entirely repaid in 20 years. Mt. Werner would make payments for the entire 20-year period and the City would contribute to the payments for the final 12 years of the loan. Mt. Werner would rely primarily upon service charge revenues, the City's property tax rebate ($200,000 per year for the first eight years of the loan - discussed in Section 4.6.2), and the City's proposed annual contribution of approximately $175,000 (for the final 12 years of the loan) in order to repay the loan from the Authority. Potential sources of revenue for the City's contribution for the final 12 years would include user charges, tap fees, and most likely, debt service subsidies from the general fund (Birch, 1992). A copy of the proposed reservoir financial plan is included in Appendix I.

3.5 WETLANDS

3.5.1 Introduction

Information and data used to prepare the following discussion was developed as a result of field studies completed at the project study area during portions of July, September, and October of 1992. The field studies were conducted, following a review of proposed construction alternatives and project maps, in accordance with methodology set forth in the publication *Corps of Engineers' Wetlands Delineation Manual* (1987) for a "routine on-site determination". Details of the methodologies used to complete the field surveys, as well as the results of the field effort, can be found in the document *Wetland Technical Memorandum -Fish Creek Reservoir Expansion Project* (Cedar Creek, 1992a) submitted to the U. S. Forest Service.

3.5.2 Wetlands Delineation

For the purposes of the wetland discipline, the term "project area" includes the acreage as shown on Figure 3-20. Red stippling on the map indicates areas for which wetlands were mapped in total and included those acreages associated with the proposed reservoir expansion, borrow area and campground alternatives as well as the proposed spillway and transportation corridor alternatives, where new construction is proposed. Green stippling indicates where the extent of wetlands was estimated along proposed transportation corridors and where the existing road would be used in an upgraded condition. Upgrading would consist of graveling and would not likely disturb the adjacent wetlands.

Wetlands within the study area (Figure 3-20) occur primarily over low-lying, gently sloping topographies, though wetlands have developed in more level meadows at higher elevations where run-on and snowpack give rise to wetter soil moisture regimes. These wetlands support plant communities consisting almost entirely of wetland (FAC, FACW, OBL classes) plant species including various sedges, rushes, and tufted hairgrass. Tufted hairgrass is also the dominant species in wetland transition zones and in wetland meadows at the drier end of the soil moisture spectrum. Wetland meadow soils have dark chroma matrices of 2 or less and exhibit bright mottles with values/chromas ranging from 3/6 to 4/6. Gleyed soils can occasionally be found at deeper depths in the soil profile. In terms of wetland hydrology indicators, these soils are normally saturated and occur within obvious drainage topographies. Standing water was also present near many wetland meadow sample points, though water depths rarely exceeded a few inches at the time of the field surveys.

By comparison, upland meadows within the study area support a wide variety of plant species. The percentage of upland species (FACU and UPL classes) comprising the relative plant cover at meadow sample sites ranges from 46 to 90 percent, and includes such species as eriogonum, grouse whortleberry, gland cinquefoil, strawberry, sheep fescue, and mountain brome. Soil matrix chromas range from 2 to 6 and no mottling or gleying was found. Lying above the adjacent wetlands, these sites displayed no wetland hydrology characteristics. Upland meadow transition zones display essentially the same soil and hydrology characteristics as upland meadows but support higher percentages of FAC and FACW species.

Wetlands along the shoreline circumference of Fish Creek Reservoir and the southeast portion of the shoreline of Puppy Dog Lake are characterized by vegetation communities composed almost entirely of wetland vegetation. Dominant species include rushes, sedges, diamond-leaf willow, and tufted hairgrass. Soils exhibit low chromas and/or mottling and are inundated or saturated at or near the surface. Wetlands occurring along Granite Creek and other unnamed drainages, support a vegetation community dominated by sedges, rushes and willow species. Tufted hairgrass, and occasionally common reed, are also dominant vegetation community components along the more gently sloping portions of these drainages. Soils are gleyed or exhibit bright mottles in soil matrices having chromas of 2 or less. Wetland hydrology indicators include wetland drainage patterns, soils saturated to within 12 inches of the surface, and occasionally inundated soil profiles.

The uplands associated with these wetlands support plant communities dominated by conifers, eriogonum, strawberry, and various upland-classed grass species. Wetland-classed plants make up from 10 to 30 percent of the plant community at the sample sites. Soils have matrix chromas ranging from 2 to 4 with no evidence of mottling or associated wetland hydrology indicators.

Project No.: 828-1500	Design By: Cedar Cr. Assoc.	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC3WET.DWG	Drawn By: T. Smith	Date: January, 1993	
FIGURE 3-20			RESERVOIR WETLAND/UPLAND BOUNDARIES

Upland mixed conifer forests, characteristic of the remainder of the study area, are dominated by a variety of upland vegetation species including Englemann spruce, lodgepole pine, and grouse whortleberry, with a virtual absence of wetland-classed vegetation. Soil matrices exhibit chromas of 4 or brighter and there was no indication of wetland hydrology. Forest sites at lower elevations and sites considered upland transition zones normally support a slightly greater percentage of wetland-classed species within a predominantly upland plant community. Wetland vegetation in these areas consists primarily of tufted hairgrass and alpine timothy. Soils have matrix chromas of 3 or greater with no evidence of mottling or gleying. No indications of wetland hydrology were found.

3.6 SOILS

3.6.1 Introduction

Existing Forest Service mapping and data were used to develop the following discussion of the soil resources of the project area (John, 1992). Field surveys were completed in the Fish Creek Reservoir area in the summer of 1988 by the Forest Service. A map depicting soil mapping units was then drafted at a scale of 1 inch:2,000 feet based on the results of these surveys. Data used to prepare this section consisted of Forest Service field pedon descriptions, map unit descriptions, and interpretive summaries based on soil, physical, and chemical characteristics. No site-specific soil surveys were completed as a part of this project.

3.6.2 Soils Description

A total of five mapping units were identified within the study area as depicted on Figure 3-21. A summary of pertinent soil characteristics for these units is presented in Table 3-18. The map units consist of a single dominant series, complexes, or soil associations indicating a highly variable soil mantle overlying the study area.

TABLE 3-18
SUMMARY OF SELECTED MAP UNIT CHARACTERISTICS

MAP UNIT NO.	MAP UNIT COMPONENT	DRAINAGE	PERMEABILITY	AVAILABLE WATER CAPACITY	RUNOFF POTENTIAL
44	Grenadier family	Well	Moderately rapid	Very low - low	Moderate
	Cryohemists	Poor	Moderately rapid	High	Very slow or ponded
74	Hanks series	Well	Moderate	Low	Moderate
	Unnamed series	Well	Moderate	Low	Moderate
75	Aquic Cryochrepts	Somewhat poorly	Moderate - moderately slow	Moderate - High	Slow
	Terric Cryohemists	Very poorly - poorly	Moderate	High	Very slow or ponded
80	Grenadier family	Well	Moderately rapid	Very low - low	Moderate
	Cryohemists	Very Poor	Moderately rapid	High	Slow or ponded
612C	Taglake series	Well	Moderately rapid	Low	Slow

Soils overlying the acreage bordering Fish Creek Reservoir (Map Unit 612C) are deep and forming in glacial till parent materials. Soil textures range from very stony sandy loams at and near the surface to very stony loamy sands at depth. Coarse fragment content ranges from 50 to 65 percent throughout the profile and soil pH values are 5.4 to 5.8. Water erosion, compaction, and revegetation potentials for this map unit are all rated as moderate.

Soils occurring in the western portion of the project area on valley side-slopes and bottoms (Map Unit 44) are forming in residuum/colluvium from volcanic rock sources and decomposing organic materials, respectively. These soils are typically moderately deep to deep. Soils overlying side-slopes exhibit very flaggy loam to extremely flaggy sandy loam textures with the coarse fragment content of the soil profile ranging from 60 to 65 percent throughout. Soil pH values are typically 5.0 to 5.4. Soils of the valley bottoms generally consist of decomposing vegetative material to a depth of over 50 inches, below which is soil material with loamy textures. The coarse fragment content of these soils is very low and pH values range from 5.4 to 5.8. The water erosion, compaction, and revegetation potentials of the dominant soils of this map unit are moderate, slight, and low, respectively. Rock outcrops make up about 35 percent of this unit. Soil Map Unit 80 occurs over a portion of the southwestern part of the project area. This unit is similar to Map Unit 44, in terms of soils present, though approximately 60 percent of the unit is composed of rock outcrop formations. Higher soil coarse fragment contents, in the form of stones and cobbles, may also occur in soils overlying sideslopes.

Map Unit 74 occurs in the southeastern portion of the project area on glacially scoured ridges. The dominant soils of this unit are deep and are developing in residuum from volcanic rocks and glacial till. Soils forming in residuum have textures ranging from gravelly fine sandy loams to gravelly loams with coarse fragment contents of 20 percent or less throughout the profile. Soils forming in glacial till exhibit textures ranging from cobbly loams at the surface to very cobbly loamy fine sands at depth. Coarse fragment content of these soils varies from 15 to 45 percent. The pH values for the soils of this unit ranges from 4.6 to 5.2. Water erosion potential of the soils of this unit is rated as moderate. Soil compaction potential ratings for these soils range from moderate to severe while revegetation potentials range from low to moderate. Soils in the eastern portion of the study area (Map Unit 75), overlying more gentle slopes in drainages and valley bottoms are forming in alluvium and decomposing organic materials. These soils are deep to very deep. Alluvial soils have textures ranging from cobbly and very cobbly sandy loams, to gravelly sandy clay loams. Coarse fragment content ranges from 15 to 45 percent increasing with depth. Soil pH values vary widely from 4.8 to 6.8. Soils forming in organics exhibit a surface layer of organic material 15 to 50 inches thick over a stratified subsurface soil layer with textures ranging from gravelly sandy clay loams to gravelly loamy sands. Coarse fragment content ranges from 15 to 35 percent and pH values range from 5.4 to 6.4. The water erosion hazard for this unit is rated as low. Compaction potential, for the soil rated, is moderate. Revegetation potential ratings range from low to moderate.

3.7 VEGETATION

3.7.1 Introduction

The following discussion is based on both existing information and the results of site-specific field studies conducted in July, 1992. Existing information includes Forest Service file data, background material for sensitive plants, herbarium specimens of those sensitive plants, and both color infra-red and true color aerial photography. Field efforts necessitated two separate trips, one for sensitive species in July during the period of anthesis (flower blooming), and a second at a later time. General vegetation community identification, mapping, and characterization work was completed in late

LEGEND

N. 420,000

- EXISTING RESERVOIR SITE
- PROPOSED HIGH WATER LINE
- SOILS STUDY AREA
- SOIL MAP UNIT BOUNDARY
- PROPOSED BORROW AREA

74 SOIL MAPPING UNIT

- 44 - GRENADIER FAMILY, CRYOHEMISTS
- 74 - HANKS SERIES, UNNAMED SERIES
- 75 - AQUIC CRYOCHREPTS, TERRIC CRYOHEMISTS
- 80 - GRENADIER FAMILY CRYOHEMISTS
- 612C - TAGLAKE SERIES

N

0' 500' 1000'
SCALE
CONTOUR INTERVAL: 10'

Project No.: 828-1500	Design By: Cedar Cr. Assoc.	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC3SOILS.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-21			SOILS LOCATION MAP

July. Details of the methodologies used to complete the field work and the results of surveys are found in the document *Vegetation Technical Memorandum-Fish Creek Reservoir Expansion Project* (Cedar Creek, 1992b) on file with the U.S. Forest Service. Figure 3-22 depicts the study area for the vegetation discipline and the boundaries of the vegetation communities identified.

3.7.2 Vegetation Communities

Three vegetation communities were identified and mapped as a result of the field surveys. These communities include the Mixed Conifer Forest, Upland Meadow, and Wetlands communities. Two additional features of the physical environment were also delineated during the vegetation studies to aid wildlife habitat evaluations. These features include open water and disturbed areas. Table 3-19, Selected Vegetation Community Data, presents selected data for the three vegetation communities identified on site.

TABLE 3-19
SELECTED VEGETATION COMMUNITY DATA

VEGETATION TYPE	ECOLOGICAL STATUS	CONDITION AND TREND	AVERAGE GROUND COVER (%)	ANNUAL HERBACEOUS PRODUCTION lbs. (dry wt.)/ac	CARRYING CAPACITY AUMs[1]/ac
Mixed Conifer	Late seral	Excellent, stable	85	300	0.071
Upland Meadow	Late seral	Good, stable	64	1,300	0.25
Wetlands	Late seral	Good, stable	93	2,300	0.55

[1]AUMs - Animal Unit Months

The Mixed Conifer community is the most extensive vegetation type of the study area occupying 487 acres. It occurs on all slopes, aspects, and topographic positions except low-lying wet meadows. A total of 37 plant species were observed in this community with Englemann spruce (*Picea englemannii*), lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*) and grouse whortleberry (*Vaccinium myrtillus*) being the most dominant species. Tree canopy cover is often over 60 percent and ground cover of living plants averages 85 percent. Ground cover, however, is highly variable depending upon shading from the tree canopy and underlying soils, and can range from less than 20 percent under dense tree canopy cover to 98 percent in more open areas. Tree and shrub densities were estimated to be 450 stems and 18,000 plants per acre, respectively. Vegetation structural diversity of this community is considered to be excellent except in areas of extensive bedrock exposures, where little understory is present. Total current annual herbaceous production was estimated to be about 300 pounds (dry weight) per acre with about 50 percent of this production usable by livestock. This level of production reflects an overall carrying capacity of 0.071 AUMs (Animal Unit Months) per acre, for both livestock and/or wildlife, under a program of proper forage utilization. Condition and trend of the Mixed Forest community was estimated to be excellent and stable, respectively. The ecological stage of this community was classed as late seral.

The Upland Meadow community is the second most extensive vegetation type in the study area exhibiting 185 acres. This community is typically located along upper slopes and rolling hills between the Mixed Conifer and Wetlands vegetation types. A total of 52 species were identified in this type resulting in a comparatively high species diversity. Structural diversity, conversely, was only fair owing to the single stratum (herbaceous) present. Dominant species included tufted hairgrass (*Deschampsia caespitosa*), timothy (*Phleum alpinum*), elk sedge (*Carex geyerii*), wiregrass (*Juncus* sp.), and green needlegrass (*Stipa viridula*). Ground cover of living plants was estimated to average about 64 percent, though values as high as 80 percent were recorded in more dense stands of grasses and forbs. Woody plant density averaged about 550 plants per acre. Total current annual

production was estimated to be 1,300 pounds (dry weight) per acre of which about 40 percent was usable by livestock. This translates to a carrying capacity of approximately 0.25 AUMs per acre. This community is considered to be in a late seral ecological stage with condition and trend estimated to be good and stable, respectively.

The wetlands community is the least extensive vegetation type in the study area as it is found on 146 acres. Additional discussion of this type is found in Section 3.5. As indicated on Figure 3-22, "jurisdictional wetlands" are those which have been mapped and field verified for Corps of Engineer (COE) jurisdictional purposes (ie. they are subject to impact by the proposed project or project alternatives). "Other study area wetlands" were not field verified, are not subject to impact, and therefore, need no jurisdictional direction from the COE. The wetlands community is typically found in the lowest topographic positions, where seeps occur near the surface. A total of 43 species were observed in this community. Like the Upland Meadow, the structural diversity of this community is rated as fair, due to the single dominant herbaceous stratum present. Dominant vegetation species include tufted hairgrass, sedges, planeleaf willow (*Salix planifolia*), and Baltic rush (*Juncus balticus*). Ground cover of living plants was estimated to be 93 percent on average, but can reach as high as 100 percent in the densest areas. Overall, shrub density was estimated to be about 800 stems per acre. Carrying capacity for this community was calculated to be 0.55 AUMs per acre assuming a total current annual production of about 2,300 pounds (dry weight) per acre, a 50 percent usable forage ratio, and proper grazing management. Estimated to be in the late seral stage, the Wetlands community exhibits good range condition and stable trend.

3.7.3 Sensitive Species

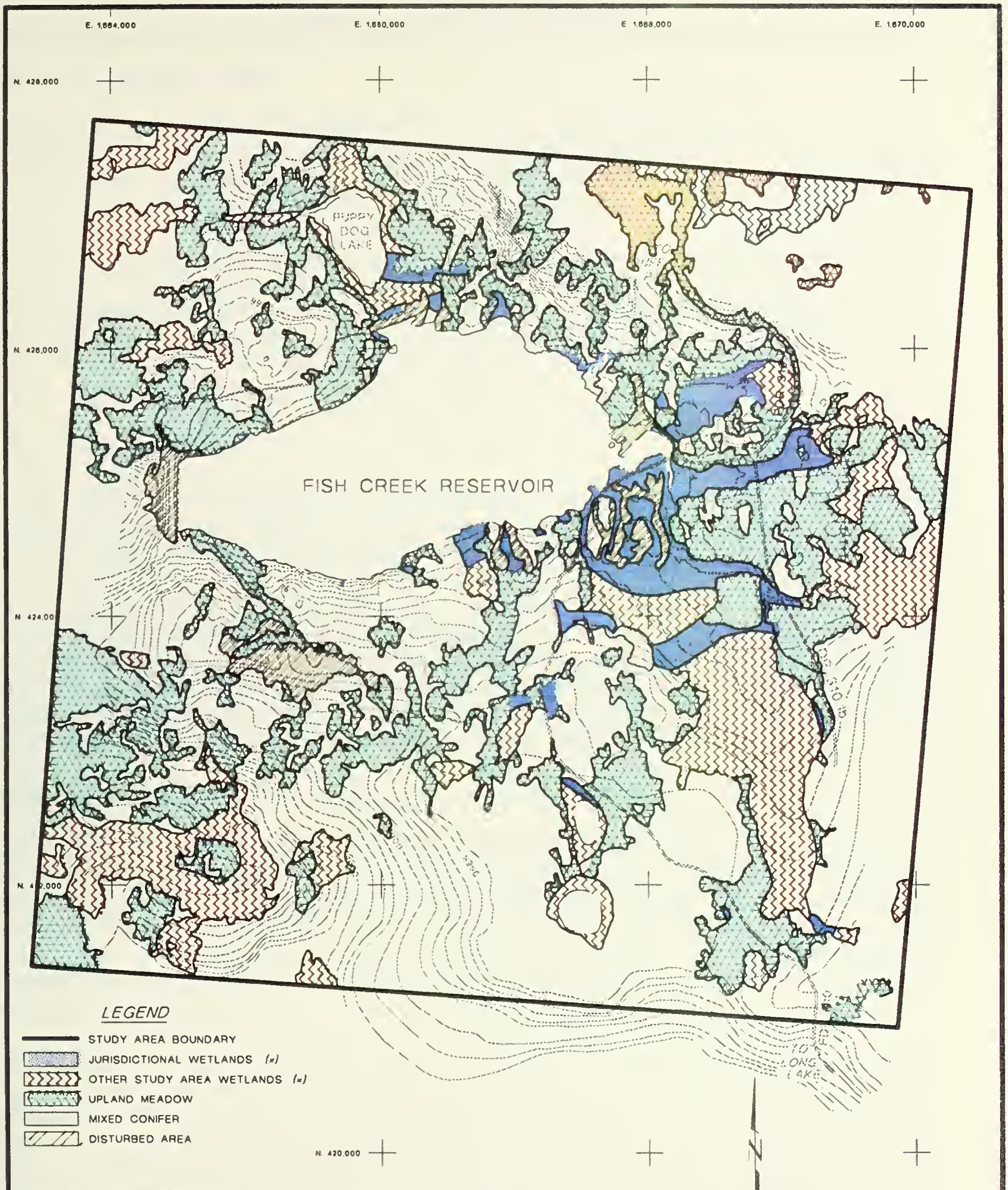
Evaluation of sensitive species' literature (USDI, 1985) and information provided by the US Fish & Wildlife Service to the US Forest Service, under informal consultation, indicated that several sensitive floral species could possibly occur in the study area as indicated in the Table 3-20.

TABLE 3-20
SENSITIVE PLANT SPECIES POTENTIALLY OCCURRING ON SITE

SCIENTIFIC NAME	COMMON NAME	FEDERAL LISTING
Claytonia lanceolata flava	Spring beauty	C2
Cypripedium fasciculatum	Brownie ladyslipper	C2*
Ipomopsis aggregata weberi	Skyrocket gilia	C2*
Mimulus gemmiparus	Weber monkey-flower	C2
Penstemon harringtonii	Harrington beardtongue	C2
Potentilla effusa rupinicola	Larimer cinquefoil	

*Status expected upon the next notice of review of candidate plants.
C2 - Category 2 Candidate (pending additional information on species' status)

Following intensive systematic surveys during the period of anthesis, none of the sensitive plants listed above were observed within any area which may be disturbed, including a large surrounding buffer. A list of the plants which were observed is provided in the document *Vegetation Technical Memorandum-Fish Creek Reservoir Expansion Project* (Cedar Creek, 1992b).



NOTE: (*) - Jurisdictional Wetlands are those which have been mapped & field verified for Corps Of Engineers (COE) jurisdictional purposes (i.e. they are subject to impact). Other study area wetlands were not field verified, are not subject to impact, & therefore, need no jurisdictional direction from the COE.

0' 500' 1000'
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CONTOUR INTERVAL 10'

Project No.: 828-1500	Design By: Cedar Cr. Assoc.	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC3VEG.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-22			RESERVOIR VEGETATION MAP

3.7.4 Range Management

According to Forest Service personnel (Schmitzer, W., 1992), the proposed project area is within the Long Lake Allotment which consists of 9440 acres. The registered permittee is the Stratton Sheep Co. of Rawlins, Wyoming, who operates one band of sheep (1000 ewe/lambs) with a season of use between July 16th and September 10th of each year. This totals to a utilization of about 350 AUMs.

The carrying capacity of the vegetation types found in and around the project area were presented above in Table 3-19. Based on the acreage of these types found in the 940 acre study area, a total of about 160 AUMs could be available in this area. However, owing to a restriction of sheep use of a large buffer zone around the reservoir, this forage would be largely unavailable to the permittee.

3.8 WILDLIFE/FISHERIES

3.8.1 Introduction

Information regarding wildlife species and current habitat conditions within the Fish Creek Reservoir expansion project area was obtained from a review of existing published sources, Colorado Division of Wildlife (CDOW) file and computer database information, and on-site field surveys.

As indicated in Section 3.7, Vegetation, three major vegetation communities/wildlife terrestrial habitats (mixed conifer, upland meadow, and wetland) occur within the project area. Open water associated with Fish Creek Reservoir, small ponded areas, and creeks provides aquatic habitat in the project area. Wildlife populations within the project area are discussed in the following sections: Big Game; Other Mammals; Raptors; Waterbirds and Upland Gamebirds; Other Avifauna; Reptiles and Amphibians; Fish; and Threatened, Endangered, and Candidate Species.

3.8.2 Big Game

The project area occurs within CDOW Game Management Unit 14 . Mule deer, elk, black bear, and mountain lion are expected to occur on or near the project area. Habitat preferences of these species are reviewed in the *Wildlife Technical Memorandum* (Cedar Creek, 1992c). Black bear and mountain lion are known to occur in the Routt National Forest but are not expected to be common in the vicinity of the project area, due to the intensity of human recreational activities associated with Fish Creek Reservoir, and trail systems in the area. No observations of black bear or mountain lion or their definitive sign (scat or tracks) were made during field surveys in the project area.

Mule deer and elk populations within the region of the project area exhibit significant seasonal movement, with most shifts in distribution occurring as a result of elevational migration in response to weather patterns and snow cover. Deer and elk habitat within the project area is used solely as summer range because heavy snowfall accumulations occur during the winter months. Mule deer and elk migration from summer range in the region, to winter range at the lower elevations, occurs generally in a westerly direction. For mule deer, winter range is represented primarily by sagebrush and mixed shrub habitats, especially where exposure limits snow accumulations. Principal mule deer wintering areas occur to the west of National Forest lands in the Hayden, Craig, and Maybell areas (CDOW, WRIS). Elk winter range extends to higher elevations than mule deer winter range since elk are not as restricted by snow cover as are mule deer. Elk winter range generally occurs below the 8,400-foot elevation level and is typified by oak brush and mixed shrub slopes where exposure limits snow accumulation. The closest elk severe winter range and winter concentration areas are located predominantly below the 7,600-foot elevation level north and south of the Town of Steamboat Springs and adjacent to the Routt National Forest boundary (CDOW, WRIS).

Elk calving or production areas are defined as the portion of the range occupied by cow elk from May 15 to June 15. Elk production areas in the project area region occur in the lower elevation portions of summer range or in ranges that are transitional between winter and summer range. No elk production areas have been identified by the CDOW near the project area, and calving activity would not be expected because of its high elevation location and the lack of suitable habitats (Cedar Creek, 1992c). The closest known production areas are located at the intermediate elevations (7,200 to 9,200 feet) in the Walton, Storm King and Beaver Creek drainages, southwest of the project area and between the Spring Creek and North Fork of Fish Creek drainages, west of the project area (CDOW, WRIS).

Field surveys documented the occurrence of both mule deer and elk in the project area. Tracks and pellets of both species were encountered relatively infrequently along most survey transects and no evidence of elk or mule deer concentration areas was encountered.

3.8.3 Other Mammals

Furbearers and predators potentially occurring in the project area include muskrat, beaver, coyote, red fox, marten, long-tailed weasel, ermine, mink, wolverine, badger, striped skunk, bobcat, and lynx. Wolverine and lynx are federally listed as Candidate (C2) species and are discussed in Section 3.8.9.

Field surveys only documented the presence of coyote and beaver. Due to the secretive nature and nocturnal habits of many of the furbearers, little information on distribution and population densities within the project area is available. Habitat preferences of these species and the potential for their occurrence within the project area are discussed the *Wildlife Technical Memorandum* (Cedar Creek, 1992c).

The marten is a species of interest because it has been selected by many of the National Forests as a Management Indicator Species to represent species using mature and old-growth forest habitats. Martens prefer mature, mesic coniferous or mixed forests with at least a 30 to 50 percent crown density (Koehler et al. 1975, Allen 1982). They avoid large, open areas and clearings, but may use small riparian areas and meadows for foraging (Spencer et al. 1983). Upland meadow and wetland areas represent suitable foraging habitat for the marten, and this species may occur in the project area where these habitats occur, adjacent to mature mixed conifer forest.

A variety of small and medium-sized mammals also occur within the project area. Many of these represent an important food source for raptors and mammalian predators. Field surveys documented the presence of six species of small mammals: least chipmunk, golden-mantled ground squirrel, yellow-bellied marmot, northern pocket gopher, red squirrel, and porcupine. Other potential small mammals inhabitants are listed in the *Wildlife Technical Memorandum* (Cedar Creek, 1992c).

3.8.4 Raptors

Several species of raptors are known to occur and nest within forested habitats in the region of the project area. Three raptors, Cooper's hawk, northern goshawk, and red-tailed hawk, were documented in the project area during the 1992 field period. Other summer or year-long residents in the area include sharp-shinned hawk, golden eagle, American kestrel, great horned owl, northern pygmy owl, long-eared owl, boreal owl, and northern saw-whet owl (Cedar Creek, 1992c). Suitable nesting habitat is present on or near the project area for all these species, but no nest sites or evidence of nesting activity of any raptor species were located during the 1992 field period. Habitat preferences for nest sites of these species are discussed in the *Wildlife Technical Memorandum* (Cedar

Creek, 1992c). The northern goshawk is federally listed as a Candidate (C2) species and is discussed in greater detail in Section 3.8.9.

3.8.5 Waterbirds and Upland Gamebirds

Waterbirds include waterfowl, shorebirds, and other wading birds typically associated with wetlands and bodies of surface water. In the project area, surface water is present along small mountain streams, in shallow depressions in upland meadows, and at Fish Creek Reservoir. High elevation in combination with the general lack of shallow-water shoreline areas, and emergent vegetation around water bodies, favored by many species of waterfowl and shorebirds, limits waterbird use of the project area. Spotted sandpiper, common snipe, and California gull were the only waterbirds observed in the project area during the 1992 field period. Most waterbird use of the project area is expected to be by spring and fall migrants, preferring the open water habitat of Fish Creek Reservoir and Puppy Dog Lake. Some use of the perimeter of Puppy Dog Lake and the creeks and associated narrow bands of wetland habitats by puddle ducks (such as mallard and teal), spotted sandpiper, and killdeer for resting, feeding, or nesting is expected.

The only upland gamebirds expected in the project area are blue grouse and mourning dove. Blue grouse occur as year-long residents within the Routt National Forest, while the mourning dove is present only as a summer resident. Blue grouse prefer open areas of conifers or aspen with an understory of shrubs or stands of mixed shrubs with adjacent conifers or aspens. Blue grouse generally are found near a source of water or succulent vegetation and are most likely to occur near the edges of mixed conifer and meadow habitats within the project area. Mourning dove occur in a variety of habitats but prefer agricultural and riparian areas supporting seed producing forbs and grasses near water. This species is not common within the project area. No observations of mourning dove or blue grouse were recorded during the 1992 field period.

3.8.6 Other Avifauna

A variety of songbird and similar species, associated primarily with high elevation coniferous forest and meadow habitats, reside within the project area. Most occur as migrants or summer residents, and only a few species remain in the region during the winter months. Many of the woodpeckers, jays, chickadees, nuthatches, and finches are year-round residents, while the majority of the songbirds migrate south or to lower elevations for the winter months. Songbird and similar species observed during the 1992 field surveys, or potentially occurring within the project area, are listed in the *Wildlife Technical Memorandum* (Cedar Creek, 1992c). Species observed within the project area during the 1992 field period, included 25 songbirds, one hummingbird, and two woodpecker species.

3.8.7 Reptiles and Amphibians

The diversity of amphibians and reptiles in the vicinity of the project area is limited by high elevations and a relatively short, frost-free season. Potential reptilian residents in the project area include: short-horned lizard, western smooth green snake, and wandering garter snake. Potential amphibian residents in the project area include tiger salamander, boreal toad, boreal chorus frog, wood frog, and northern leopard frog. The boreal toad is a federally listed Candidate (C2) species, while the wood frog is listed by Colorado as Threatened. Both species are discussed in Section 3.8.9 The other amphibian species occur in a variety of habitats, but all require permanent or intermittent sources of surface water for breeding. Boreal chorus frog was the only amphibian or reptile observed within the project area during the 1992 field surveys.

3.8.8 Fish

Aquatic habitat within the project area is present in Fish Creek Reservoir, Puppy Dog Lake, small tributary streams to Fish Creek Reservoir, and small pools that have formed in shallow depressions in moist meadow areas. Suitable habitat for cold-water fish species is present in Fish Creek Reservoir, Puppy Dog Lake, the outlet stream from Puppy Dog Lake, Middle Fork Fish Creek and Granite Creek which feed Fish Creek Reservoir, and Middle Fork Fish Creek downstream of the reservoir.

Fish Creek Reservoir is formed by an earth and rock dam approximately 55 feet high and 650 feet in length. Total surface area of the lake is approximately 90 acres, and its maximum depth is approximately 53 feet. Shoal areas comprise 15 percent of the reservoir, and the predominant bottom types are rock and gravel. Fluctuating water levels and regular drainings for maintenance have limited the development of shoreline emergent vegetation.

Rainbow trout were stocked in Fish Creek Reservoir from 1961 until 1984, while brook trout have been stocked since 1986 (Sealing, 1992). Small numbers of rainbow trout remain in the reservoir, but brook trout are the principal sport fish. The brook trout fishery is considered self-sustaining, but occasional drainings for reservoir maintenance limit the viability of this fishery. Suitable trout spawning habitat exists in the reservoir at the outlet to Puppy Dog Lake and in the inlet streams. Brook trout were observed in Fish Creek Reservoir, Puppy Dog Lake, and Granite Creek during the 1992 survey period.

Flow from the Fish Creek Reservoir spillway is routed into Puppy Dog Lake on the north side of Fish Creek Reservoir. Water flow from Puppy Dog Lake exits from the northwest corner of the lake and proceeds down the outlet stream channel approximately one mile before entering the Middle Fork Fish Creek below Fish Creek Reservoir. Spring high-flow releases of water from the Fish Creek Reservoir spillway have resulted in channel erosion in the outlet stream channel from Puppy Dog Lake.

Puppy Dog Lake is shallow meadow type lake with a total surface area of approximately 6 acres. The perimeter of Puppy Dog Lake exhibits a shallow gradient, and the shallow water shoreline areas support extensive stands of emergent vegetation composed primarily of sedges.

As indicated previously, Middle Fork Fish Creek and Granite Creek feed Fish Creek Reservoir. Portions of these creeks above the reservoir would be inundated by reservoir expansion. An evaluation of these streams by the CDOW was completed in August 1992 (Skinner, 1992). The reach of Middle Fork Fish Creek within the potential inundation area is a very steep, step-pool stream type. No fish were observed in this section of stream, and fish habitat was rated as poor because of its steep gradient. Above the inundation area, the stream gradient is less steep, and several brook trout (5 to 7 inches in length) were noted in the plunge pools in this section of the stream. The reach of Granite Creek, within the potential inundation area, is a mountain meadow type stream with a much shallower gradient than that of Middle Fork Fish Creek. Brook trout habitat in this stream reach is considered high quality. Brook trout, observed in Granite Creek, were numerous but small (most were less than 5 inches in length).

3.8.9 Threatened, Endangered, and Candidate Species

No identified critical habitat for any state or federally listed threatened or endangered species has been identified within or near the Fish Creek Reservoir project area. Table 3-21 lists Federal and State Threatened, Endangered, and Candidate species potentially occurring near the project area.

Information on the habitat preferences and known distribution of each listed species is provided in the following sections.

TABLE 3-21
THREATENED, ENDANGERED, AND CANDIDATE SPECIES POTENTIALLY OCCURRING NEAR THE PROJECT AREA

Common Name	Scientific Name	Status[1]
MAMMALS		
Wolverine	*Gulo gulo*	C2, EC
Lynx	*Felis lynx*	C2, EC
BIRDS		
Bald eagle	*Haliaeetus leucocephalus*	E, EC
American peregrine falcon	*Falco peregrinus anatum*	E, EC
Northern goshawk	*Accipiter gentilis*	C2
AMPHIBIANS AND REPTILES		
Boreal toad	*Bufo boreas boreas*	C2
Wood frog	*Rana sylvatica*	TC
FISH		
Colorado River cutthroat	*Oncorhynchus clarki pleuriticus*	C2

[1]Status:
- E - Listed Endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act. Species which are in imminent jeopardy of extinction.
- C2 - Category 2 Candidate as listed by the U.S. Fish and Wildlife Service under the Endangered Species Act. Species being considered for listing as Threatened or Endangered pending more information.
- EC - Listed by the Colorado Division of Wildlife as endangered in Colorado. A species in immediate jeopardy of becoming extinct throughout all or a significant portion of its range.
- TC - Listed by the Colorado Division of Wildlife as threatened in Colorado. A species not in immediate jeopardy of extinction but is vulnerable because it exists in small numbers or is so restricted throughout all or a significant portion of its range that it may become endangered.

Four state and federal listed endangered species (Colorado squawfish, humpback chub, and bonytail and razorback sucker) occur within the Colorado River drainage downstream of the study area. These listed species do not occur within or near the study area, but alterations in water management within the study area could affect their downstream habitats in the Colorado River drainage system.

Wolverine (C2) - Wolverines prefer rugged, relatively inaccessible mountainous areas at the high elevations in the summer and move to lower (but still snow-bound) elevations in the winter (Hornocker and Hash, 1981). They occur in low densities in large roadless or isolated areas. Wolverines are adapted for carrion feeding and take their food from carcasses of large animals such as elk and deer (Hornocker and Hash, 1981). Wolverines also kill smaller prey such as snowshoe hare, marmot, and small rodents. The scavenging lifestyle of wolverines results in seasonally long movements and relatively large home ranges (Hornocker and Hash, 1981). Suitable habitat for wolverine is present in or near the project area, and it may occur within the range of a wolverine.

Scattered unconfirmed sightings of wolverine have been recorded in the Zirkels, with the closest to the project area being a 1973 observation near Buffalo Pass, and a 1982 observation near Rabbit Ears Pass (CDOW Fisher, Lynx, & Wolverine Database records, provided by G. Byrne, 1992). Additional unconfirmed reports of wolverine have been made in the mountains around North Park to the east of the project area (Torres et al., 1978; CDOW Fisher, Lynx, & Wolverine Database

records). The only recent confirmed record of wolverine in the state is a sighting near the East Fork Cimarron River in southwest Gunnison County (CDOW, WRIS).

<u>Lynx (C2)</u> - Historically, the lynx was found at the higher elevations through the central portion of Colorado, although it was never abundant (Torres et al., 1978). Lynx habitat is generally described as climax boreal forest with a dense undercover of thickets and windfalls (DeStefano, 1987). Advanced successional stages of forests and dense conifer stands often are preferred habitats of lynx, especially where areas of rock outcrop, bogs, or thickets are present (McCord and Cardoza, 1982). Primary prey of the lynx in North America is the snowshoe hare, especially during the winter months. During the summer, grouse and small mammal species also are taken, but snowshoe hares are typically still the lynx's main prey (Tumlison, 1987). Suitable lynx habitat exists near the project area, but no confirmed or unconfirmed sightings of this species have been recorded for Routt or nearby Jackson County (CDOW WRIS; CDOW, Fisher, Lynx, & Wolverine Database records). Lynx occurrence has been documented in Clear Creek, Eagle, Lake, and Pitkin counties (CDOW, WRIS). The most recent sightings of lynx are from the Vail area in Eagle County and the Empire area in Clear Creek County (Torres et al., 1978).

<u>Bald Eagle (Endangered, Federal and Colorado)</u> - Bald eagles occur primarily as wintering birds in Colorado, and wintering populations are known to occur along the Yampa and Colorado rivers. A few nesting records also exist for the state. Habitat for bald eagles consists of secure nesting sites, diurnal perches, winter roosts, and foraging areas usually associated with large lakes or rivers. Nesting habitats preferred by bald eagles are multi-layered, mature or old-growth forest stands removed from human disturbance and in shoreline areas adjacent to open water. Important stand characteristics include large trees and snags which provide sites for nests and perches. Preferred bald eagle nesting, foraging, or wintering habitat does not exist on or near the project area, and this species would only be expected as an occasional winter wanderer near the project area.

<u>American Peregrine Falcon (Endangered, Federal and Colorado)</u> - American and Arctic peregrine falcons are known to occur throughout the region primarily during spring and fall migration. The project area occurs within the nesting range of the American peregrine falcon. The peregrine's preferred nest site is a rugged, remote cliff (100 to 300 feet in height) usually overlooking water or marshy areas, where prey is abundant (U.S. Fish and Wildlife Service, 1984). Preferred hunting areas include cropland, meadows, river bottoms, marshes, and lakes which attract abundant bird life. Peregrines may travel up to 17 miles from nesting cliffs to hunting areas (U.S. Fish and Wildlife Service, 1984), and may occasionally wander over the project area.. Preferred nesting habitat does not exist on or near the project area, and there are no known peregrine falcon nest sites in the vicinity. The closest potential peregrine falcon nesting habitat occurs in North Park to the east of the project area (Torres et al., 1978).

<u>Northern Goshawk (C2)</u> - In Colorado northern goshawks nest in dense coniferous forest, often on north slopes and near water. Nesting also has been documented in aspen trees and in trees in riparian habitats at the lower elevations (Bailey and Niedrach, 1965). Old-growth forest habitats with a relatively open understory are preferred (Hayward et al., 1990), and the goshawk has been identified by the Routt National Forest as an indicator species for late succession habitats. Nests are typically constructed in an upper crotch of a conifer near the trunk and below the canopy top. Nesting birds are relatively intolerant of human disturbance. One observation of an adult northern goshawk was recorded during the 1992 field period. This bird was noted in flight near the edge of upland meadow and mixed conifer habitat. No nests or evidence of goshawk nesting activity (pluck sites, whitewash, or pellets) were observed in the project area.

Boreal Toad (C2) - The boreal toad occurs in the mountainous portions of Colorado and is most common between 8,500 and 11,000 feet in elevation (Hammerson, 1986). Preferred habitats in Colorado include wet meadows, marshes, and the margins of beaver ponds and lakes (Hammerson, 1986). Boreal toads breed in any body of water lacking a strong current and with gradually descending banks at some point around the perimeter (Burger and Bragg, 1947, as cited in Hammerson, 1986). The primary requirement for breeding apparently is the presence of shallow water (< 1 foot) (Campbell, 1972).

Boreal toads are known to occur at the higher elevations in Routt County (CDOW, WRIS), and boreal toad tadpoles have been found in shallow pools near Rabbit Ears Pass (Brattstrom, 1962, as cited in Hammerson, 1986). Shallow ponds in upland meadow habitat, the margins of Puppy Dog Lake, and beaver ponds associated with the feeder streams to Fish Creek Reservoir, represent suitable breeding habitat for boreal toad within the project area. Nighttime searches in wetland habitat and around ponds during the 1992 survey period did not locate any boreal toads, but they are expected to be present. Boreal chorus frog was the only amphibian located within the project area.

Wood Frog (Threatened, Colorado) - Although widespread throughout much of Alaska, Canada, and the northeastern United States, the wood frogs distribution is disjunct in Colorado and is limited to the upper tributaries of the Colorado River and the Laramie River around the margins of North Park (Hammerson, 1986). Occupied habitats include marshes, bogs, wet meadows, beaver ponds, lakes, stream borders, and moist willow thickets between 8,000 and 11,000 feet in elevation (Hammerson, 1986; CDOW, 1989). Shallow, natural ponds supporting extensive growth of sedges in shallow water areas and lacking a permanent inlet or outlet are preferred for breeding. Trout prey on wood frog larvae, and the presence of trout usually prevents successful wood frog reproduction (Hammerson, 1986). Wood frogs are rarely found in habitats occupied by trout or other amphibians (CDOW, 1989).

Shallow ponds in upland meadow habitat represent suitable breeding habitat for wood frog within the study area. The margins of Puppy Dog Lake are not expected to support wood frogs because of the presence of trout. Nighttime searches in wetland habitat and around ponds during the 1992 survey period did not locate any wood frogs.

Colorado River Cutthroat (C2) - The Colorado River cutthroat is native to the Colorado River drainage. Fishing pressure and competition with non-native species such as brook and rainbow trout have eliminated the Colorado River cutthroat from most of its original range. Its current distribution is limited to a few small headwater streams and lakes in northwest Colorado. The Colorado River cutthroat currently does not occur within the waters of the study area, but suitable habitat is present.

3.9 RECREATION

3.9.1 Introduction

The information and data used to prepare the following discussion was obtained through field visits to the study areas, interviews with the Forest Service, and by reviewing maps. The results of this analysis are presented in detail in the document *Recreation Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992d), which was submitted to the Forest Service in support of this EIS. For the purpose of the recreation discipline, two study areas were delineated. As shown in Figures 3-23 and 3-24, the primary study area consists of Fish Creek Reservoir and its immediate surroundings, while the secondary study area encompasses portions of the Routt National Forest surrounding Fish Creek Reservoir that could be indirectly impacted by the proposed project.

3.9.2 The Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is an inventory process used by the Forest Service that categorizes the recreational resources on a forest. The ROS system assures that recreation is integrated into the overall land and resource management planning process. A ROS map for the primary and secondary study areas is presented in Figure 3-25. All of the campgrounds, picnic sites, and roads within the primary and secondary study areas are located in areas designated as "Roaded Natural" recreation opportunities. This designation means that recreation opportunities are provided in a natural-appearing environment in which developed structures exist but are designed in such a manner that high visual quality is maintained. Access and travel is by sedan and trailer, recreation vehicle, or motor home, via sensitive roads and trails.

The majority of the secondary study area also includes land that is designated "Semi-Primitive, Non-Motorized" during the summer, but "Semi-Primitive Motorized" during the winter. In these areas, recreation takes place in a natural-appearing environment in which only a limited amount of on-site facilities exist. During the summer, access is restricted to non-motorized travel but during the winter, snowmobiling is allowed.

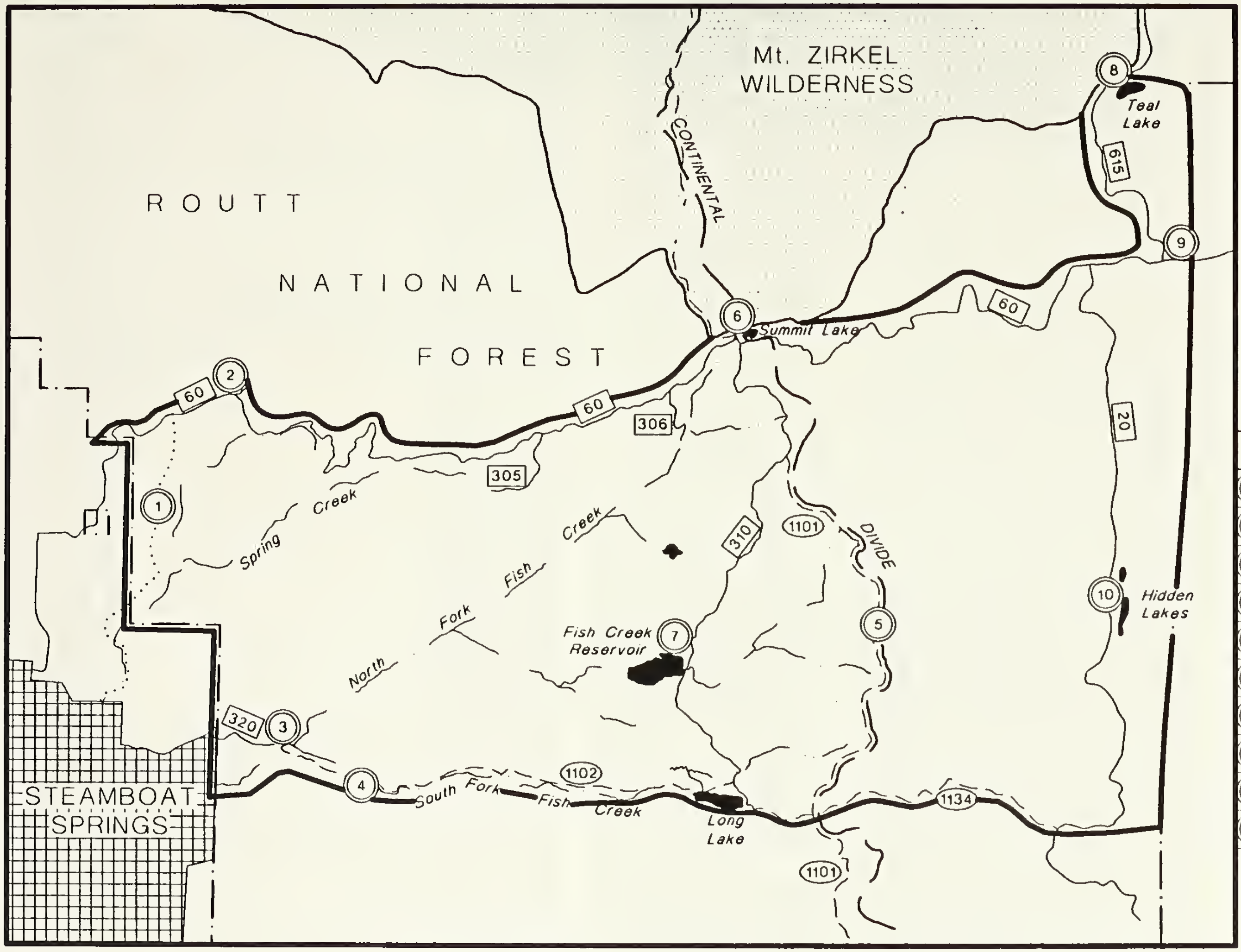
A "Primitive" area exists in portions of the forest to the west and to the south of Long Lake. In this area, recreation opportunities are offered in a natural-appearing environment in which no on-site facilities exist, little interaction between visitors occur, and access is restricted to non-motorized travel.

3.9.3 Recreational Resources

Figure 3-24 shows the location of recreation facilities within the primary and secondary study areas. Located on the eastern shore of Fish Creek Reservoir, Granite Campground is the only developed facility within the primary study area. Open during the summer months only due to early and late snow cover, the Forest Service campground is a non-fee, walk-in campground with four campsites and one vault toilet which presently is not operational. The facilities also include a small parking lot, dispersed picnic tables, and a gravel boat ramp. In addition, a limited amount of dispersed camping sites can be found along a user-created trail that circles the reservoir. Because Fish Creek Reservoir has only a limited amount of developed facilities, the reservoir provides a rather pristine and uncrowded recreation setting, even when the campground is full. Although use is typically concentrated on the weekends, the campground's low user capacity (approximately 25 persons at one time) and seasonally limited access protects the nature of the recreation setting.

Recreation facilities, located in the secondary study area, include five campgrounds that provide a total of 62 campsites. Operated by the Forest Service, these campgrounds consist of Dry Lake Campground, Summit Lake Campground, Teal Lake Campground, Grizzly Creek Campground, and Hidden Lakes Campground. All of these campgrounds are closed during the winter, due to snowfall. Summit Lake Campground is centrally located at the top of Buffalo Pass and thus acts as a "hub" for a variety of recreation opportunities. There are sixteen campsites and two large parking lots that accommodate people visiting the Mount Zirkel Wilderness, Fish Creek Reservoir, Long Lake, the Wyoming Trail, or Summit Lake. Dry Lake Campground is the smallest and most primitive of the five campgrounds, and is located on the west side of Buffalo Pass along FDR 60. Grizzly Creek, Teal Lake, and Hidden Lakes Campgrounds are all fee areas and are located on the eastern edge of the secondary study area. Also found within the secondary study area is Fish Creek Falls Recreation Area. Operated by the Forest Service, this facility is located at the end of FDR 320, just outside

Project No.: 828-1500	Design By: L. LABOVITCH	Scale: SEE SCALE BAR	FISH CREEK RESERVOIR EIS
File: FC3PSA.DWG	Drawn By: T. CLARK	Date: January, 1993	
FIGURE 3-23			RECREATION PRIMARY STUDY AREA



LEGEND

- ROUTT NATIONAL FOREST BOUNDARY
- TRAIL
- ROAD
- MOUNTAIN BIKE TRAIL
- Mt. ZIRKEL WILDERNESS
- SECONDARY STUDY AREA

RECREATION SITE	FACILITIES
1 × SPRING CREEK MOUNTAIN BIKE TRAIL	MOUNTAIN BIKE TRAIL
2 DRY LAKE CAMPGROUND	CAMPSITES (8)
3 FISH CREEK FALLS PICNIC GROUND	PICNIC SITES (4) HIKING TRAIL VIEWPOINT
4 FISH CREEK FALLS TRAIL - No. 1102	HIKING TRAIL
5 WYOMING TRAIL No. 1101	HIKING TRAIL
6 SUMMIT LAKE CAMPGROUND	CAMPSITES (16) FISHING HIKING TRAILS
7 GRANITE CAMPGROUND	CAMPSITES (4) FISHING HIKING TRAILS
8 TEAL LAKE CAMPGROUND	CAMPSITES (17) FISHING HIKING TRAILS
9 GRIZZLY CREEK CAMPGROUND	CAMPSITES (12)
10 HIDDEN LAKES CAMPGROUND	CAMPSITES (9) FISHING

× NOT MAINTAINED BY U.S.F.S.

SOURCE: U.S.F.S - FOREST SERVICE-ROUTT NATIONAL FOREST.

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File: FCEXR.DWG	Drawn By: T. SMITH	Date: January, 1993

FIGURE 3-24

FISH CREEK RESERVOIR EIS

EXISTING DEVELOPED RECREATION FACILITIES

of Steamboat Springs, and contains a parking area, four picnic sites, and viewing areas of the falls. Unlike the other facilities in the study area, Fish Creek Falls Recreation Area is open during the winter.

There are four main trails located within the secondary study area. Trail #1101, also called the Wyoming Trail, or the Continental Divide Trail, begins approximately one mile south of Summit Lake, along FDR 310, and follows the Continental Divide south. Trail #1102 begins at Fish Creek Falls and continues east to Long Lake, where it meets with Trail #1134, which continues east to FDR 20. All three of these trails are maintained by the Forest Service. The Spring Creek Trail is a popular hiking and mountain biking trail that connects Steamboat Springs with Buffalo Pass Road (FDR 60). This trail is currently not maintained by the Forest Service.

3.9.4 Recreational Activities

The most common activities that occur at Fish Creek Reservoir are camping, picnicking, and fishing. Generally, the reservoir receives its greatest use on the weekends and holidays, and lower use on the weekdays. Granite Campground records approximately 1,000 Recreation Visitor Days (RVD's) per year (Recreation and Travel Management Report, 1992). Dispersed camping in non-developed sites is most common during the hunting seasons in October and November, but occurs occasionally throughout the summer. Fishing is the most popular type of dispersed recreation activity that takes place at the reservoir. The Colorado Division of Wildlife stocks the reservoir with brook trout. Fishing often occurs along the banks of the reservoir, from float tubes and from non-motorized boats. Other dispersed forms of recreation that take place in the primary study area include picnicking, hiking, and mountain biking. In the winter, snowmobilers and backcountry skiers are able to access the reservoir, but exact use patterns are not known.

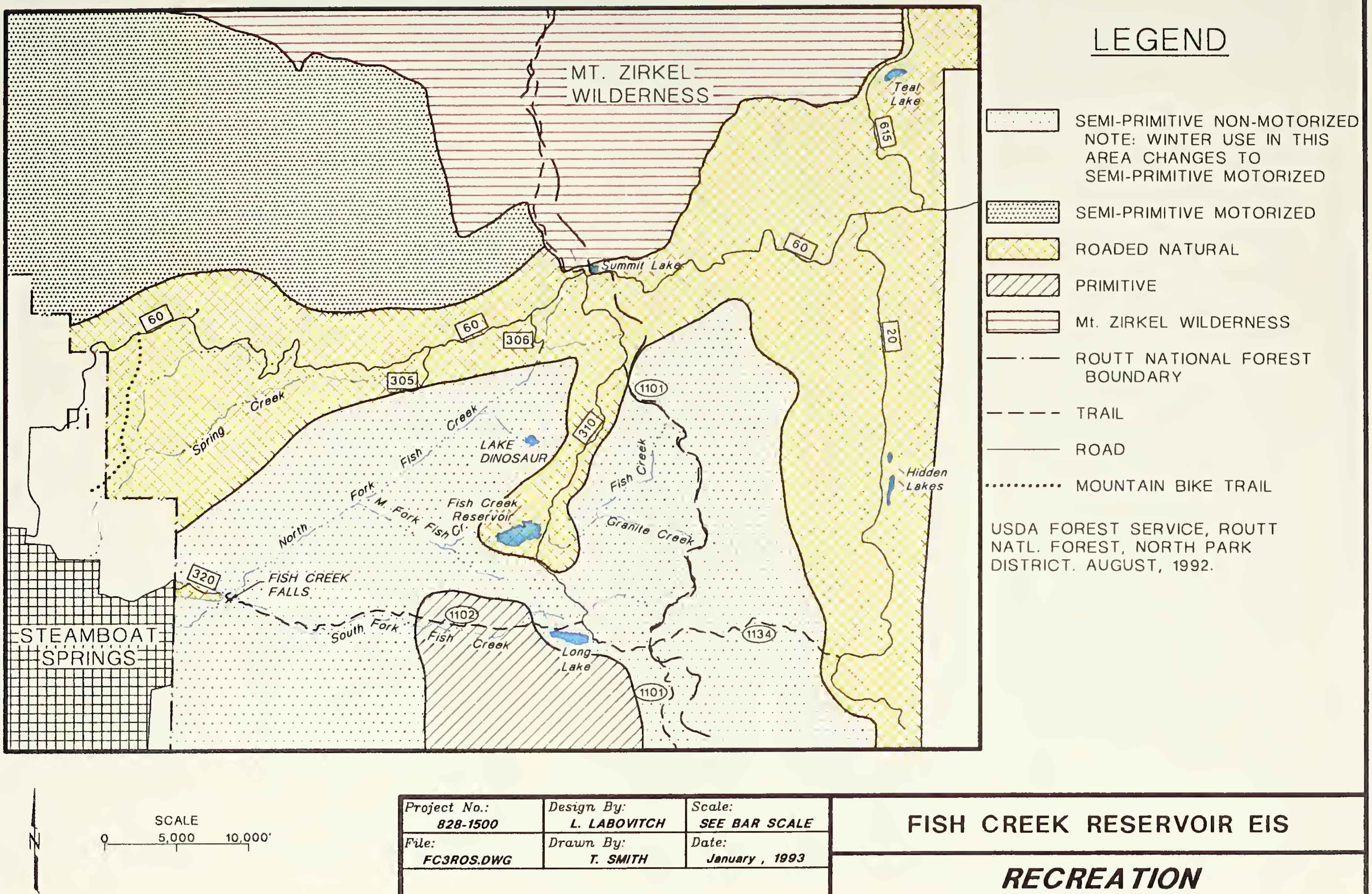
Because the secondary study area is quite expansive, and contains a considerably larger amount of developed facilities, it accommodates many more visitors per year than the primary study area. As with the primary study area, recreational use in the secondary study area is typically concentrated on the weekends and holidays. Estimated annual RVD's for each campground in the secondary study area are presented in Table 3-22. The total RVD's for all of the campgrounds is estimated at 18,600 per year. Fish Creek Falls Recreation Area typically records 12,500 to 15,000 RVD's annually (Forest Service Capital Investment Project Proposal, 1991).

TABLE 3-22
ESTIMATED ANNUAL RECREATION VISITOR DAYS (RVD's) FOR CAMPGROUNDS IN THE SECONDARY STUDY AREA

CAMPGROUND	NUMBER OF CAMPSITES	ESTIMATED RVD's
Dry Lake Campground	8	2,400
Summit Lake Campground	16	4,800
Grizzly Creek Campground	12	3,600
Hidden Lakes Campground	9	2,700
Teal Lake Campground	17	5,100

NOTES: (1) Calculations based on the following assumptions:
60 percent occupancy rate
5 visitors per campsite
100 day use season

SOURCE: Schmitzer, Rob. Personal Communication. USDA Forest Service, Routt National Forest, Hahns Peak District Ranger Office. September, 1992.



Project No.: 828-1500	Design By: L. LABOVITCH	Scale: SEE BAR SCALE	FISH CREEK RESERVOIR EIS
File: FC3ROS.DWG	Drawn By: T. SMITH	Date: January , 1993	

FIGURE 3-25

RECREATION OPPORTUNITY SPECTRUM

Hiking, mountain biking, camping, horseback riding, and fishing are the most common activities occurring in the secondary study area. Mountain biking is a rapidly growing sport and has become very popular along Buffalo Pass. Fish Creek Falls Trail (#1102), the Spring Creek Trail, FDR 60, and FDR 310 are the most commonly used routes, accommodating beginner, intermediate, and expert riders. Use conflicts have begun to occur, however, between mountain bikers and hikers using the Fish Creek Falls Trail. Camping and fishing are popular in both developed and dispersed recreation sites. Most of the forest, except FDR 310, is open to vehicle travel for up to 300 feet off designated roads and trails, for the purpose of dispersed camping and firewood collection *(Recreation and Travel Management Report, 1992).* Summit Lake, Teal Lake, and Hidden Lakes are stocked by the Colorado Division of Wildlife and are heavily fished. Dinosaur Lake, although it is not stocked and is not accessible by maintained trails, is also fished occasionally. Hiking and horseback riding are also very popular and occur frequently along designated trails throughout the secondary study area.

During the winter, snowmobiling and backcountry skiing are very popular in the secondary study area. Steamboat Powdercats, a commercial ski operation that operates under a Forest Service special use permit, makes alpine skiing available along Buffalo Mountain, on the west side of Buffalo Pass. Cross-country and telemark skiing take place throughout the secondary study area, although no official trail system has been established. Snowmobiling is legal in most parts of the forest, except in the Mount Zirkel Wilderness, Steamboat Ski Area, and in elk winter ranges, and is enjoyed frequently by enthusiasts.

The Forest Service feels that many of the developed facilities in the secondary study area, particularly trails and campgrounds, are being overused in the summer. Dispersed recreation is not as significant of a problem, but the current demand for developed recreational opportunities, especially on the weekends, is often greater than the available supply of facilities. During the winter, overcrowding occurs at the Buffalo Pass Road Winter Trailhead at Dry Lake during weekends and other high use days.

3.9.5 Future Recreational Use/Development

In the future, recreational use of the Routt National Forest is expected to increase. The main factors involved in this increase are: 1) the main access road into the Buffalo Pass area (FDR 60) is scheduled to be upgraded and will allow a wider variety of vehicles to get to selected recreation sites along the Buffalo Pass corridor; 2) current marketing strategies for Steamboat Springs have attracted more summer visitors to the area, and have broadened the summer tourist season; and 3) due to the proximity of the Routt National Forest to Steamboat Springs, expected population increases in Steamboat Springs will have a direct impact on visitor numbers in the Buffalo Pass area. Because recreational use in this area is already high, however, proposals are being made by the Forest Service to upgrade areas which typically see heavy use, and to better disperse visitors throughout the Routt National Forest. These plans include the expansion and upgrading of campgrounds, construction of new trails, an increase in available parking, and the upgrading of roads.

As part of the Forest Service plans, Dry Lake Campground would be expanded and Summit Lake Campground and Fish Creek Falls Recreation Area would be upgraded. Twenty new campsites (including vehicle pull-through sites), a new water system, and composting toilets, would be built at Dry Lake Campground. Dry Lake trailhead was constructed in the summer of 1992, for use during summer and winter recreation seasons. The Forest Service also plans to pave the campground's roads and rehabilitate the existing campsites. At Summit Lake Campground, the Forest Service proposes to enlarge parking facilities, install a new water system and composting toilets, landscape trailheads, and upgrade the existing campsites, picnic areas, and trails. At the Fish

Creek Falls Recreation Area, reconstruction of the trails and facilities is scheduled for 1995 and Fish Creek Falls Road is scheduled to be paved in 1994 (AGO, 1991). In addition, plans to upgrade and expand Granite Campground are being developed as proposed mitigation to the Proposed Action.

A number of new trails and trailheads have also been proposed by the Forest Service. The Forest Service plans to enlarge the parking area at the end of FDR 310 near Fish Creek Reservoir and install a formal sign that identifies the trail that continues from the reservoir to Long Lake. There are also plans to reestablish a loop trail that once connected Dinosaur Lake with FDR 310. Although this trail currently sees limited use, it is not included in the Forest Service trail system, due to its poor condition. Future plans involve rehabilitating the trail, constructing a trailhead along FDR 310, and providing a parking area. There are also plans to improve the Spring Creek Trail. In order to resolve current conflicts with private land owners, the Forest Service proposes to re-route this trail around the private property through which it currently passes. In so doing, the Forest Service could then maintain the trail as part of the Forest Service trail system. The new Spring Creek Trail would likely tie in with the Dry Lake Trailhead.

Construction of the Mountain View Trail, connecting Mt. Werner (the top of the ski area) with Long Lake, is tentatively scheduled for 1996. This trail would be accessible to mountain bikers, hikers, and cross-country skiers. It is also likely that a nordic ski hut system will be analyzed in the near future. This type of trail would allow skiers to travel between Rabbit Ears Pass and Buffalo Pass.

3.10 TRANSPORTATION

3.10.1 Introduction

The information presented in the following discussion was obtained from test drives of the existing transportation routes, interviews with appropriate road agencies (including Jackson County, Routt County, and the Forest Service), and by examining Forest Service topographical maps. Existing transportation routes were assessed under the following categories:

- Location and Ownership
- Road Conditions
- Traffic Loads
- Proximity to Streams
- Road Maintenance

Each of these categories is considered important to the viability of the road system and its ability to support increased traffic as a result of the Proposed Action or project alternatives. A detailed account of the transportation analysis is presented in the *Transportation Baseline Technical Report for the Fish Creek Reservoir Expansion EIS (ACZ, 1992e).*

3.10.2 West Route

3.10.2.1 Location and Ownership

The transportation routes studied for this analysis are shown in Figure 3-26, Transportation Routes. The West Route from Steamboat Springs to Fish Creek Reservoir begins at the junction of Amethyst Drive and Routt County Road (RCR) 36, and proceeds north on RCR 36 to RCR 38. It then continues east 1.7 miles on RCR 38 to the Routt National Forest boundary, where it becomes Forest Development Road (FDR) 60 and continues east 9.1 miles to Buffalo Pass. It then proceeds south

on FDR 310 for 4.4 miles to Fish Creek Reservoir. Routt County has jurisdiction over RCR 36 and RCR 38. The Forest Service has jurisdiction over FDR 60 and FDR 310 (Snowden, 1992).

The intersection of Amethyst Drive and RCR 36 can be accessed through the City of Steamboat Springs by two different routes. Both routes begin at the intersection of Lincoln Avenue and 3rd Street and are shown in Figure 3-27, City Access Routes. City Access Route 1 proceeds along paved roads past the Post Office to Fish Creek Falls Road, and then to Amethyst Drive, where it passes through residential neighborhoods and past Strawberry Park Junior High and Elementary Schools. City Access Route 2 proceeds downtown along paved roads to 7th Street, then passes through residential neighborhoods.

3.10.2.2 Road Conditions

The condition of the West Route varies, according to Forest Service definitions, from 'paved' to 'all-weather' to 'dirt' roads. The general road conditions are good at the beginning but drop to fair as you continue along the route. A detailed description of all sections of the West Route is shown in Table 3-23, West Route Road Conditions.

There are several culverts which run underneath the road along the West Route. A number of these culverts have less than one foot of cover. The Forest Service requires that the thickness of cover over a culvert be 2/3 the diameter of the culvert. A minimum diameter of 18 inches is required by the Forest Service for metal culverts.

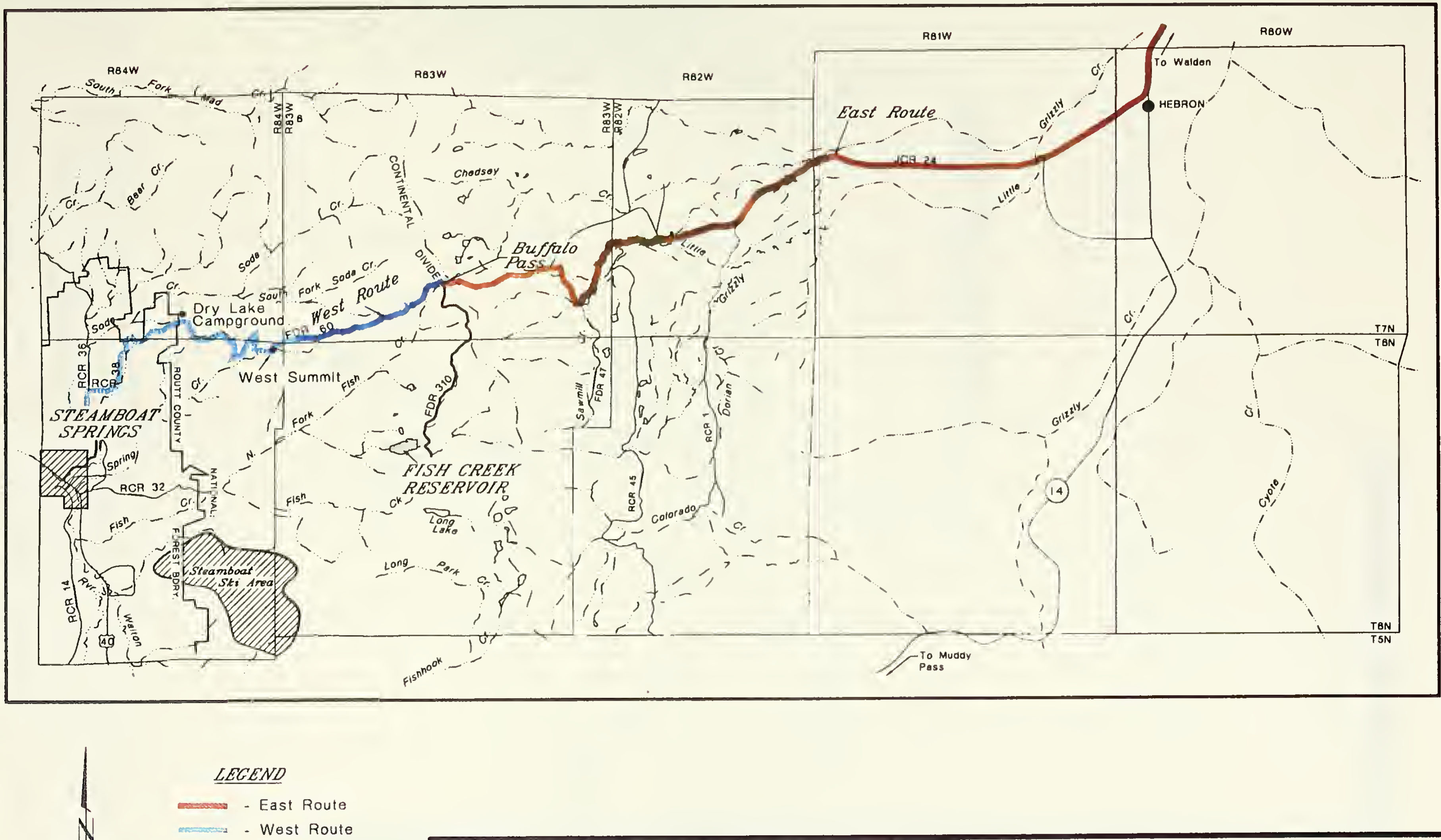
A dust suppressant and binder (lignon sulfinate) was added to the first half mile of RCR 38 to stabilize the road base and to suppress the dust. According to the County, this has proven to be effective, as this section of the road requires less maintenance than the rest of the road.

According to the Forest Service, the west side of FDR 60 will be upgraded in the near future to be a double-lane asphalt road from RCR 38 to Dry Lake Campground; a single-lane double chip-seal road with turnouts from Dry Lake Campground to the West Summit; and a single-lane gravel road from the West Summit to the top of Buffalo Pass.

TABLE 3-23
WEST ROUTE ROAD CONDITIONS

Section	Road	Length (miles)	Width (feet)	Grade (%) Avg.	Grade (%) Max	Alignment	Surface	Creek Miles (miles)	Comments
RCR 36	RCR 36	1	25	2.5	2.5	Very Good	Pavement	0	
Start of RCR 38 To End of Pavement	RCR 38	0.24	15	0	0	Very Good	Pavement	0	
End of Pavement to Dry Lake Campground	RCR 36/ FDR 60	2.95	25	8	10	Fair	Gravel	1.1	Semi-smooth, well compacted, good drainage
Dry Lake Campground to Buffalo Pass	FDR 60	7.6	15 to 20	5	13	Poor/Fair	Native Material	1.0	Semi-rough, well compacted, some protruding rock, good drainage
Buffalo Pass to Fish Creek Reservoir	FDR 310	7.6	15	2	10	Fair	Native Material/Aggre gate	.6	Semi-rough well compacted, some protruding rock, good drainage

Notes: RCR - Routt County Road
FDR - Forest Development Road
Creek Miles - Length of Road Adjacent to Creek



Project No.: 828-1500	Design By: T. LEIDICH	Scale: 1"=2 MILES
File: FC3TRAN.DWG	Drawn By: T. CLARK	Date: January, 1993

FIGURE 3-26

FISH CREEK RESERVOIR EIS

TRANSPORTATION ROUTES

Project No.: 828-1500	Design By: T. LEIDICH	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC3CITY.DWG	Drawn By: T. CLARK	Date: January, 1993	

FIGURE 3-27

CITY ACCESS ROUTES

3.10.2.3 Traffic Loads

Traffic counts were conducted on FDR 60 at Dry Lake Campground in 1981, 1988, 1991. The results are shown on Table 3-24, Traffic Counts. As shown in Table 3-24, the Average Daily Traffic (ADT) on the west side of FDR 60 for 1991 was 108 vehicles, with the ADT on the weekends twice that of weekdays. Peak travel times were between 11 am and 6 pm.

TABLE 3-24
TRAFFIC COUNTS

Year	Route	ADT	ADT		Peak Hours (time)
			Weekend	Weekday	
1981	West	88	NA	NA	NA
1988	West	106	166	83	11 am to 6 pm
1991	West	108	173	83	11 am to 6 pm
1983	East (1)	33	NA	NA	NA
1988	East (1)	88	NA	NA	NA
1988	East (2)	88	NA	NA	NA
1991	East (2)	88	173	83	11 am to 5 pm

Notes: ADT - Average Daily Traffic
(1) - East Route from the intersection with Saw Creek Road west.
(2) - East Route at Grizzly Creek Campground

3.10.2.4 Proximity to Streams

The proximity of roads to perennial and intermittent creeks was analyzed in order to assess the probability of a transportation-related spill, contaminating a stream channel. 'Close proximity' to a stream is defined as any location where a road is within 100 feet of a creek; or if the topography grade is 15 percent or greater, within 250 feet of a creek. It is assumed that, in reaches where the road is within the defined proximity of a stream, a potential spill has a high probability of reaching the creek before cleanup can be completed.

The West Route is in close proximity to several creeks for a total of 2.7 miles of its 15 mile length. Table 3-23, West Route Road Conditions, provides information regarding the proximity of the creeks to associated road sections.

3.10.2.5 Road Maintenance

The West Route is maintained by both Routt County and the Forest Service. The gravel portion of RCR 38 and FDR 60 up to Dry Lake Campground is bladed approximately once per week (Gabos, 1992). The remaining part of FDR 60 and FDR 310 are usually bladed twice annually (Snowden, 1992). Snow removal in past years has been performed by Routt County to the parking area at the end of RCR 38. Beginning this year, however, Routt County will perform snow removal up to the Dry Lake Campground. Above Dry Lake Campground, the West Route is closed during the winter, except to snowmobiles and skiers.

3.10.3 East Route

3.10.3.1 Location and Ownership

As shown in Figure 3-26, Transportation Routes, the East Route begins at the junction of State Highway 14 and Jackson County Road (JCR) 24. The route proceeds down JCR 24 for 10.8 miles to the Grizzly Creek Campground and then proceeds 8.5 miles along FDR 60 to Buffalo Pass where it intersects FDR 310. It then continues 4.4 miles along FDR 310 to Fish Creek Reservoir. Jackson County has jurisdiction over JCR 24 and the Forest Service, North Park District has jurisdiction over FDR 60 on the east side of the continental divide (Cobb, 1992).

3.10.3.2 Road Conditions

The condition of the East Route varies, according to Forest Service definitions, from 'paved' to 'all-weather' to 'dirt' to 'unimproved' road. The general condition of the East Route is good at the beginning but it deteriorates to poor for 2.75 miles before Buffalo Pass. A detailed description of the all sections of the East Route are shown in Table 3-25, East Route Road Conditions.

There are several culverts along the East Route, a number of which have less than one foot of. In addition, there are a number of drainage dips on the 2.75 mile length of road before Buffalo Pass.

According to the Forest Service, the east side of FDR 60 will be upgraded in the near future to a single-lane gravel road with turnouts and two scenic viewing areas (Cobb, 1992).

3.10.3.3 Traffic Loads

Traffic counts were conducted on FDR 60 at Grizzly Creek Campground and at the junction of Sawmill Creek Road in 1983 and 1991. The results of these surveys are shown on Table 3-24, Traffic Counts. As shown on Table 3-24, the ADT for the east side of FDR 60 during 1991 was 88 at Grizzly Creek Campground and 29 at the Sawmill Creek Road intersection. Like the west side, the ADT on the weekends was approximately twice that of weekdays. Peak travel time was between 11 am and 5 pm.

3.10.3.4 Proximity to Streams

The East Route is in close proximity to several creeks for a total of 1.7 miles of its 18 mile length. Detailed information on specific sections of the East Route is presented in Table 3-25, East Route Road Conditions.

3.10.3.5 Road Maintenance

The East Route is maintained by both Jackson County and the Forest Service. The gravel portion of JCR 24 is bladed 6 to 7 times annually (Gerr, 1992). The east side of FDR 60 is bladed at least once, and sometimes twice, annually (Cobb, 1992). Snow removal up to Sawmill Creek Road is done by Jackson County. FDR 60, beyond the Sawmill Creek Road intersection, is closed during the winter.

3.10.4 On-Site Roads

3.10.4.1 Existing Site Roads

All site roads are shown on Figure 3-28, Site Transportation Plan. Currently, FDR 310 extends past Fish Creek Reservoir to Long Lake, but is closed to public vehicle travel from the reservoir to the lake. Referred to as FDR 310.2, this road is used by the Forest Service and the City to access Long Lake. FDR 310.2 is an improved dirt road which was reconstructed with an aggregate surface approximately five years ago (Schmitzer, R., 1992). It has some steep grades, and is ditched and cross drained with culverts.

Approximately 0.5 miles from Fish Creek Reservoir, a double-track four-wheel drive road branches off of FDR 310.2 and continues to the reservoir's dam and saddle dam. This road is very steep with very poor alignment and little drainage. It is also closed to the public.

FDR 310.1B, also a continuation of FDR 310, continues south from Fish Creek Reservoir approximately 0.2 miles to Forest Service Trail #1101.1A. FDR 310.1B is a rough dirt road with good alignment and moderate grades, and is constructed with native material.

3.10.4.2 Road Corridor Options

If the proposed Fish Creek Reservoir expansion is approved, the first quarter mile of FDR 310.2 would be inundated. Three road corridor options have been proposed to route FDR 310.2 around the proposed reservoir. All three of the road options are shown on Figure 3-28, Site Transportation Plan.

Other proposed plans for the site include the realignment and upgrading of the two-track four-wheel drive road that provides access from FDR 310.2 to the reservoir's dam and saddle dam. The road would be realigned in order to replace the section inundated by the proposed reservoir expansion and to bypass environmentally sensitive meadows. Upgrading would include regrading and the addition of drainage structures and gravel. The sections that would be realigned are also shown on Figure 3-28.

3.11 VISUAL RESOURCES

3.11.1 Introduction

The Fish Creek Reservoir is located two miles west of the Continental Divide, near Buffalo Pass. The 90-acre reservoir is an important aesthetic asset to the Routt National Forest. As discussed in the Recreation Section (Section 3.9), the reservoir is used for many different types of recreation activities. Although access is limited due to the condition of the roads, the reservoir, recreational facilities, and adjacent lands are used for camping, picnicking, boating, hiking, hunting, and fishing. In addition, many people pass by the reservoir along Fish Creek Reservoir Road (FDR 310) on mountain bikes, on foot, or in cars. Due to the limited access, the reservoir and adjacent lands provide a relatively uncrowded, pristine environment for recreation.

The existing visual resources in the project area were analyzed using the Forest Service Visual Resource Management System. This system is described in detail in the *Visual Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992f).

TABLE 3-25
EAST ROUTE ROAD CONDITIONS

Section	Road	Length (miles)	Width (feet)	Grade (%)		Alignment	Surface	Creek Miles (miles)	Comments
				Avg.	Max				
Start of JCR 24 To End of Pavement	JCR 24	7.5	30	1.5	15	Good	Pavement	0.7	
End of Pavement to Grizzly Creek Lake Campground	JCR 24	0.24	30	6	10	Good	Gravel	0	Well Maintained, well compacted, good drainage
Grizzly Creek Campground to Junction with Sawmill Creek Road	FDR 60	1.8	15 to 20	6	10	Fair	Native Material	0.3	semi-smooth, well compacted good drainage
Junction with Sawmill Creek Road to Start of Steep Section	FDR 60	1.2	15	12	16	Poor/Fair	Native Material	0.1	Semi-rough, well compacted some protruding rock, good drainage
Start of Steep Section to Buffalo Pass	FDR 60	2.8	10	10	20	Poor	Native Material	0.05	Rough, a lot of rock, poor drainage
Buffalo Pass to Fish Creek Reservoir	FDR 310	4.4	15	2	10	Fair	Native Material	.6	Semi-rough, well compacted some protruding rock, good drainage

Notes: JCR - Jackson County Road
FDR - Forest Development Road
Creek Miles - Length of Road Adjacent to Creek

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FIGURE 3-28

SITE TRANSPORTATION PLAN ALTERNATIVES B & C

3.11.2 Project Site Visibility

The proposed expansion would only be seen from within the immediate vicinity of the reservoir. The hills and ridgelines enclosing the Middle Fork Fish Creek basin would obscure the site from much of the adjacent forest. The project site would not be visible from the following areas:

- Fish Creek Falls Recreation Area
- Fish Creek Trail
- Buffalo Pass
- Mt. Werner

Additionally, Fish Creek Falls, located on the South Fork of Fish Creek, would not be affected by the project. Flow from the reservoir enters the Middle Fork of Fish Creek which joins the South Fork of Fish Creek approximately 200 feet downstream of the falls (see Figure 3-6).

3.11.3 Existing Visual Condition

3.11.3.1 Viewpoint Locations

Six key viewpoints were selected for the purpose of assessing existing visual conditions (Figure 3-29). The key viewpoints consist of the six locations that are, or have the potential to be, the most frequented by the public and that have a relatively clear view of proposed project features. The location of each viewpoint is described below.

Viewpoint A - This viewpoint is located at the southwestern edge of the existing campground and includes views of the reservoir and the main dam (see Figure 4-1).

Viewpoint B - This viewpoint is located at the western edge of Campground Relocation Site 1 (see Figure 2-5) looking towards the reservoir (see Figure 4-2).

Viewpoint C - This viewpoint is located along FDR 310, immediately after its intersection with the turnoff to Fish Creek Reservoir (see Figure 4-3). This viewpoint is intended to examine impacts to the hikers, mountain bikers, and others travelling along FDR 310.

Viewpoint D - This viewpoint is located at the point at which FDR 310 becomes a trail leading to Long Lake reservoir (see Figure 4-4). This area is currently used by mountain bikers and hikers and is being considered for upgrading by the Forest Service into an official trailhead.

Viewpoint E - Viewpoint E is located on the existing campground access road, looking towards the proposed campground (see Figure 4-5). This viewpoint is included to examine the visual impacts of a relocated campground.

Viewpoint F - This viewpoint is located on the northern shore of the reservoir, on a point west of the existing saddle dam, looking towards the saddle dam (see Figure 4-6).

3.11.3.2 Landscape Description

The Fish Creek Reservoir and its surrounding landscape is characterized by the rocky terrain and undulating topography typical of areas near the Continental Divide. The vegetation is characterized by large stands of mixed conifer forest interspersed with open, upland meadows and montane wetlands. The mixed conifer forest is dominated by Engleman spruce, lodgepole pine and subalpine

fir. In addition to the large expanse of water provided by the reservoir, there are many smaller bodies of water in the area, such as wetlands, creeks, and lakes, including Summit Lake, Dinosaur Lake, and Long Lake.

Specific views of the project site from the six viewpoints are characterized by the horizontal lines of the treeline and existing dam and the rolling form of the hills. Foreground trees provide contrasting vertical lines in Viewpoints A and B. The reservoir shoreline provides undulating, rounded lines from Viewpoints A,B, and C. Where the foreground consists of coniferous trees and/or rocky slopes (Viewpoints A,B, and F), the texture is generally coarse. Where open meadows and wetlands comprise the foreground (Viewpoints C,D, and E), the texture is finer grained.

When the reservoir is full, the reservoir shoreline appears relatively natural, due to the rocky shoreline interspersed with vegetation. There are two small islands with vegetation and a number of small, unvegetated rock outcroppings protruding above the water surface. The water is relatively clear, due to its high-mountain snowmelt characteristics. The shoreline is relatively stable, since water levels do not fluctuate except during annual drawdowns. The reservoir historically has been drawn down on an annual basis, beginning in August and ending with the spring runoff period (April or May), to approximately 35 percent of its storage capacity.

When the reservoir is full, the existing 650 foot long dam is visible from Viewpoints A and C. The dam has a crest height of 55 feet, which is visible from Middle Fork Fish Creek downstream of the dam. Upstream of the dam, only the freeboard is visible when the reservoir is full. If drawn down completely, the entire 55-foot height is visible. The dam's horizontal lines are compatible with the area, but the dam's straight, rigid quality and the lack of trees behind much of it make it obviously a man-made structure. The rock rip-rap, however, helps the dam blend in with its surroundings in terms of color and texture. The existing, 400-foot long saddle dam, visible from Viewpoint F, blends into the landscape in terms of color and texture, due to the rock rip-rap, but the straight, linear form of the dam contrasts with its surroundings. The saddle dam is 16 feet tall, but as with the main dam, this height is only visible from downstream (Puppy Dog Lake) or from upstream during reservoir drawdown.

The existing structures at the site (maintenance shed and vault toilet), are both situated near trees, which allow their vertical form to blend in with the surroundings. The maintenance shed's color and texture, however, are not compatible with the surroundings. In addition to the vault toilet, the existing campground contains five fire rings and picnic tables, linked by user-created trails to a gravel parking lot and boat launch. The campground facilities are generally screened by the forested setting and undulating topography. The reservoir access roads are located south of the reservoir, connecting FDR 310 to the dam, and north of the reservoir, connecting the main dam and saddle dam. These roads contrast with their surroundings in terms of color and texture.

The overall quality of the views at Fish Creek Reservoir would be considered moderate to high. The Forest Service has designated the area around the Fish Creek Reservoir as having a Class B variety class. A Class B variety is considered "common" compared to "distinctive" for Class A or "minimal" for Class C. The area's moderately rolling slopes and lack of steep, dominant landforms contribute to the Class B designation, as does the lack of outstanding or unusual rock outcrops and the lack of unusual vegetation patterns. The presence of 90 acres of water, however, increases visual variety. The reservoir is not as attractive as other Rocky Mountain Lakes surrounded by spectacular features, such as snow capped peaks, but its expansive view of water and relatively natural appearing, rocky shoreline contributes to the visual variety and creates an attractive landscape feature. Although there are many other lakes in the vicinity of Fish Creek Reservoir, there are none as large as the reservoir, and most are not as easily accessible, which gives it value in terms of scarcity.

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FIGURE 3-29

KEY VIEWPOINTS

3.11.4 Sensitivity

The Fish Creek Reservoir is of high sensitivity because of its use for recreation purposes and its proximity to a growing resort community. Although use levels are not as high as in other parts of the Forest, its location near the popular Buffalo Pass area makes it an integral part of this important recreation destination. The reservoir provides a destination for mountain bikers and others traversing the forest via Fish Creek Falls Trail, Long Lake, and the Buffalo Pass Road.

The entire Fish Creek Reservoir area has been designated by the Forest Service as a Sensitivity Level 1 area, because it is visible from a primary travel route (FDR 310) and at least one-fourth of the visitors are interested in scenic quality (USDA, no date). All of the six viewpoints would fall within this Sensitivity 1 area. The FDR 310 viewpoint (Viewpoint C) and the Long Lake Trailhead (Viewpoint D) would have the highest visitation due to the mountain bikers, hunters, hikers and others traversing the area. The campground viewpoints (Viewpoints A, B, and E) would most likely be the next most visited areas, with an estimated 1000 recreation visitor days per year (see Section 3.9). The view duration, however, is longer at the campground than at the FDR 310 viewpoints, since people at the reservoir often spend a longer time there camping, fishing, picnicking, etc. FDR 310 visitors tend to ride, walk or drive by the reservoir and thus have a shorter view duration. Viewpoint F would be the least visited viewpoint, since it can only be accessed by the informal trail along the shoreline.

3.11.5 Forest Service Management Direction

3.11.5.1 Visual Quality Objectives

Visual quality objectives provide Forest Service guidelines for reservoir and recreation facility development. The Forest Service has assigned a visual quality objective of "modification" for the area around the Fish Creek Reservoir, (Management Area 10E), as provided by the management prescriptions in the *Land and Resource Management Plan for the Routt National Forest* (USDA, 1983). This designation is based on an inventory of the area's visual quality and sensitivity, combined with consideration of the area's importance as a municipal water supply. The Fish Creek Reservoir Road (FDR 310) corridor (Management Area 2B) has been assigned a "partial retention" visual quality objective. Under the "modification" objective, facility development or forest management activities may visually dominate the landscape, but alterations must borrow from natural form, line, color, or texture so that their visual characteristics are those of natural occurrences in the surrounding area. Under the "partial retention" objective, facility development or forest management activities must remain visually subordinate and can repeat the existing form, line, color or texture or introduce new form, line, color, or texture if it remains subordinate to the visual strength of the characteristic landscape (USDA, 1974).

3.11.5.2 Existing Compliance with Objectives

The existing dam, as seen from Viewpoints A and C, meets the modification objective because, although it is obviously a man-made structure, it is visually subordinate, its texture and color borrow from the adjacent areas, its horizontal line is consistent with the horizontal lines of the hills and treelines, and its distance makes it visually subordinate from the viewpoints. When full, the reservoir itself, as seen from Viewpoints A, B, C, D, and F, represents a higher visual quality level than the "modification" objective requires, since the undulating, rocky shoreline is similar to natural lakes in the area. When the reservoir is drawn down, however, the existing visual condition is not in compliance with visual quality objectives because of the extent of exposed shoreline.

3.11.5.3 Visual Absorption Capability (VAC)

The VAC provides an indication of the relative difficulty of incorporating future activities, such as the Proposed Action, into the landscape without creating adverse visual impacts. The VAC represents the challenges in meeting visual quality objectives in the future. The *Visual Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992f) provides a more detailed explanation of VAC and how it was determined for the proposed project site. The analysis indicates that the view of the proposed project site from the key viewpoints would be at the low end of the moderate range in terms of capacity for absorbing visual changes. The moderate rating is due primarily to the area's irregular topography, medium-height trees, the presence of natural openings, and the degree of variety in the colors.

3.12 CULTURAL RESOURCES

3.12.1 Introduction

A Class III cultural resources inventory and limited testing of aboriginal archaeological sites in and around Fish Creek Reservoir was conducted by Metcalf Archaeological Consultants, Inc. A complete account of the results of this survey appear in "*A Class III Cultural Resources Inventory and Evaluative Test Excavations for the Fish Creek Reservoir Expansion, Routt County, Colorado*" (MAC, 1992). The following discussion presents the main findings of this report.

3.12.2 General Background

The project area is located west of the Continental Divide near the confluence of the Middle Fork of Fish Creek and Granite Creek. Elevation of the project area ranges from about 9,840 to 9,970 feet (2,999 to 3,039 m). Vegetation around the reservoir is a mixture of alpine wetlands and meadows in a climax forest of Spruce-Fir. Geologically, the project lies in an area where Pre-Cambrian igneous granitic rocks (circa 1.7 million years old) interfinger with Quaternary glacial drift from the Pleistocene-aged Pinedale and Bull Lake advances (Tweto, 1979). Most or all of the potential borrow areas appear to be situated over unconsolidated surface deposits which mark the Pleistocene materials. Other Pre-Cambrian metamorphic rocks of similar age to the granitic rocks are nearby and include felsic and hornblendic gneisses rocks. Although a few areas of relatively steep slopes exist, most of the project area is relatively gently sloped with rounded outcrops occasionally present. Many areas in the flat to very gently sloping valleys are actually natural depressions and contain shallow ponds. Soils in the project area were exposed along road cuts and examined during limited testing at the aboriginal sites. They are generally shallow and characterized by rounded gravels deposited during the Pleistocene. Deeper soils are undoubtedly present in the wetlands but no exposures were observed.

The climate of the area today is typical of high altitude mountain settings. Summers are short and cool, with temperatures rarely exceeding 95 degrees. Winters are cold with considerable snow fall. During winters, temperatures typically stay at or below freezing. Due to temperature inversions, it is often warmer in the higher elevations than along the Yampa River valley in the winter. Precipitation falls mainly as late summer rains and winter snows.

Prehistorically the climate was similar, but periods of warmer temperatures and greater precipitation are documented by various lines of evidence. These changes in climate probably did not cause large scale alteration of either the floral or faunal communities in the project area. Rather, small shifts in the various ecotone edges would have occurred within the immediate project area. Elevation shifts in the ecotones would have occurred outside the project area but would also have been

relatively moderate in scale. Among others, Benedict and Olson (1978) and Madole (1991) have presented discussions of paleoclimate in the Central Rocky Mountains.

Land use within the project area has been historically limited. Timbering, big game hunting, fishing and some recreational camping and hiking appear to be the dominant activities. The reservoir serves as a water source for the City. Ranching and mining do not appear to have occurred in the project area, although they have been the predominant economic activities in the Yampa River valley.

Land use prehistorically a.o appears to have been rather limited. Useful resources would include the flora and fauna. Lithic resources are limited to stones of relatively poor quality for knapping purposes. All or most of the utilization of the area would have occurred during the short summers.

3.12.3 Results of Survey

One previously recorded site was relocated and updated and two newly discovered aboriginal sites and two dams were recorded during this project. Sites were evaluated against the criteria for eligibility for inclusion in the National Register of Historic Places (NRHP) (36 CFR §60.4). All five sites are evaluated as not significant and it is recommended that they be considered not eligible for inclusion in the NRHP.

3.12.3.1 Previous Site

One site was originally located during a survey of a planned expansion of Fish Creek Reservoir similar to the current project (Jennings, 1982). It was described as a very low density lithic scatter consisting of five pieces of (unspecified lithic type) debitage over a 125 N/S x 75 E/W meter area. During the current investigations, the site was relocated. It is probably a prehistoric aboriginal open lithic scatter. Although the observed artifacts differ in number, type and distribution from those originally reported, the original documentation is essentially correct. Current investigations located six artifacts over a 90 NW/SE x 18 NE/SW meter area.

Although at least four of the six artifacts located during the current investigations are not part of the original inventory of five pieces of debitage. The overall character of the site is still a very low density lithic scatter. Based on the diversity of artifacts, and high ratio of tools to debitage, the site may be a limited activity locus. The original site map does not closely conform to the landscape and may thus overestimate the distribution of artifacts. However, the ground cover is relatively dense and additional artifacts may, in fact, exist beyond the site boundary as drawn during the current investigations.

This site is a low density artifact scatter. Limited testing and examination of numerous rodent burrow spoils failed to locate subsurface artifacts. No means of establishing chronological control was evident. Current investigations agree with the original documentation and it is again evaluated as not significant and it is recommended that it be considered not eligible for inclusion in the NRHP. No further archaeological work is recommended for the site.

3.12.3.2 Saddle Dam (ACZ-1)

The Saddle Dam (ACZ-1) site information is primarily from Jennings (1982) who cites Main (1980). It is a earthfill/rockfill dam erected in 1972 over the original spillway constructed in 1954-1955 for the Fish Creek Reservoir. It measures approximately 175 x 450 feet (53 x 137 m). It was designed as a seeping dam with a spillway around its eastern edge. Puppy Dog Lake receives the spillway waters.

No site datum or other archaeological marker was placed on the site. In addition to being too recent to be considered for the NRHP, under the Criteria, the Bureau of Reclamation has provided MAC with significance guidelines for dams (Psass, 1992). In a fashion similar to graveyards, dams are generally not considered significant in and of themselves unless they are of unique engineering, the first of their kind or in some other way atypical. The significance more often centers on their impact to local history. Although the water stored in Fish Creek Reservoir is important to the area, the Saddle Dam (ACZ-1) site would be eligible for inclusion in the NRHP only if it qualified under Criterion Exception "G" which allows consideration of sites less than 50 years old if they can be said to be of "exceptional importance". This is not the case here. Therefore, the Saddle Dam (ACZ-1) site is evaluated as not significant and it is not recommended for inclusion in the NRHP. No further archaeological work is recommended for the site.

3.12.3.3 Main Dam (ACZ-2)

The Main Dam (ACZ-2) site information is primarily from Jennings (1982) who cites Main (1980). It is a earthfill/rockfill dam erected in 1954-1955 across the Middle Fork of Fish Creek. No site datum or other archaeological marker was placed on the site. In addition to being too recent to be considered for the NRHP, under the Criteria, the Bureau of Reclamation has provided MAC with significance guidelines for dams (Psass, 1992) as discussed above in Section 3.12.3.2. The Main Dam (ACZ-2) site is evaluated as not significant and it is not recommended for inclusion in the NRHP. No further archaeological work is recommended for the site.

3.12.3.4 ACZ-3

Another site (ACZ-3) is an aboriginal lithic scatter that is probably prehistoric and is situated on the end of a ridge near Granite Creek. Large glacial boulders form the ridge, which extends above the normal waterline of Fish Creek Reservoir.

Cultural materials on the site consist of 15 chipped stone artifacts of translucent white chalcedony which grades into an opaque white coarse-grained chert and white quartzite. A biface of chert, eight tertiary flakes of chalcedony, four tertiary flakes of chert and two micro/retouch flakes of chalcedony were observed. One of the chalcedony tertiary flakes was recovered from a test probe. The sole quartzite artifact is also a tertiary flake.

This site is an open lithic scatter which, based on the types of debitage and the tool, may have been a short term camp with some tool manufacture/maintenance activities. Limited testing yielded a subsurface artifact. Given the small quantity of artifacts and lack of artifact diversity, the site is evaluated as not significant and it is recommended that it be considered not eligible for inclusion in the NRHP.

3.12.3.5 ACZ-4

Another site (ACZ-4) located is a small aboriginal lithic scatter which is probably prehistoric. The site is located between a proposed road and a potential borrow area. Site elevation is 9,940 feet.

Cultural materials on the site consist of light gray quartzite tertiary flakes and micro/retouch flakes. The materials range in size from about 6 cm to 1 cm in length. Micro/retouch flakes are present in large numbers. Twenty-two flakes were observed on the surface. The positive shovel probe yielded 17 flakes, all but four of which were less than 1 cm in length.

The site is an open lithic scatter which, based on the artifact distribution and single material type, may have been a single, very short term event consisting of tool manufacture/maintenance activity. Large flakes and retouch flakes are present, indicating both expedient tool manufacture and formal tool. Limited testing yielded a substantial amount of subsurface artifacts in relation to surface manifestations. However, given the small quantity of artifacts and lack of both artifact and arterial type diversity, the site is evaluated as not significant and it is recommended that it be considered not eligible for inclusion in the NRHP.

3.12.4 Project Evaluation

The findings of this project were as expected. Although survey conditions included a great deal of ground cover in various forms, the results of this project are comparable with a similar previous project in the same area (Jennings, 1982). The potential for additional sites in the area is relatively low because most of the areas near the major streams have been used as borrows.

The aboriginal cultural resources located reflect a pattern of low intensity transient use of higher elevations. Although evidence for more long term and even winter occupations at such elevations is becoming more common (see Metcalf and Black, 1991), settings such as the Fish Creek Reservoir were utilized primarily for the procurement of specific resources and occupations appear to be short term.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter identifies and evaluates the effects of implementing the Proposed Action or the project alternatives as described in Chapter 2. Evaluation is based upon the comparison of existing resource values, as presented in Chapter 3, with the implementation of the described alternatives. For some resource areas, the anticipated changes can be readily quantified. Others, however, can only be described in qualitative terms.

The Forest Service alternatives presented in Chapter 2 include:

- Alternative A - No Action
- Alternative B - Fish Creek Reservoir Expansion (Proposed Action)
- Alternative C - Smaller Fish Creek Reservoir Expansion

In addition to these alternatives, several options are available to Alternatives B and C. These options include borrow sites(s) designated to provide materials required for construction, service roads to the dam, power supply source, and campground location. These options are discussed within the resource areas in which their implementation has an impact.

This chapter is organized by environmental resource area, in the same manner as Chapter 3. The environmental impacts of the alternatives on the resource areas are described. Under each resource area, the direct, indirect, and cumulative impacts for the alternatives are evaluated. These impacts are defined as follows:

- Direct impacts - Those effects which occur at the same time and in the same general location as the activity causing the effects

- Indirect impacts - Those effects which occur at a different time or at a different location than the activity to which the effects are related.

- Cumulative impacts - Those effects which, when combined with similar effects from past, present, or reasonably foreseeable future actions, may result in environmental impacts.

Proposed mitigation measures are also defined under each resource area. Effective mitigation can preclude, prevent, or limit the duration and/or severity of potential project related impacts. After mitigation is discussed, the unavoidable adverse impacts to each resource area are disclosed.

4.2 DAM SAFETY/FLOOD HAZARD

4.2.1 Introduction

The Fish Creek Reservoir, located in the Routt National Forest is situated in an isolated area which is generally inaccessible from November through June of each year. Due to the site's remoteness, the reservoir's performance and flood hazard conditions are difficult to monitor and regulate on a regular basis and the ability to respond to potential dam problems is hindered.

The following discussion presents the impacts resulting from the implementation of the Proposed Action or project alternatives. The evaluation concentrates on the main and saddle dams, reservoir, outlet works and spillway. The discussion also includes potential impacts to the primary borrow sites designated to provide materials required for construction and dam service roads. The potential impacts of the power supply options are also discussed. These options (as described in Chapter 2) are relevant to the dam safety/flood hazard discussion.

4.2.2 Direct and Indirect Impacts

4.2.2.1 Alternative A - No Action

The direct and indirect impacts associated with dam safety and flood hazard under Alternative A would result in status quo conditions. In terms of dam safety and flood hazard conditions, under Alternative A, the current structure would remain in operation with no alteration to the main dam, saddle dam, or spillway. No early warning system would be installed, and thus, the City would not be alerted to potential dam problems. Annual dam inspections by the State would continue. More regular dam inspections would not be performed, since access is unavailable for up to eight months of the year (November through June) due to snowfall and weather conditions. Since no power would be installed, operation and control of the Fish Creek Reservoir outlet works would continue to be done on-site through manual adjustments to the outlet valve.

Flood hazard potential downstream of the existing Fish Creek Reservoir, due to catastrophic dam failure, is discussed in Section 3.2, Dam Safety/Flood Hazard, and also in the *Dam Safety/Flood Hazard Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992a) and the *Water Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS* (ACZ, 1992b). This discussion is based on the dambreak analysis done by Woodward-Clyde Consultants (WCC, 1992c) which is found in Appendix F. Peak flow discharges immediately downstream of Fish Creek Reservoir would be 63,200 cfs. The study indicates that peak depth on Fish Creek at the water treatment plant would be 17 feet at 1.1 hours after dam failure. A flood wave of 20 feet would occur on Fish Creek at Highway 40 at 1.3 hours after dam failure. The peak depth on the Yampa River at Riverside Drive would be 10 feet at 1.9 hours after dam failure. Table 4-1, Results of Dambreak Analysis for Fish Creek Reservoir, presents the peak flow, peak depth and elapsed time from dambreak for each of the three alternatives.

4.2.2.2 Alternative B - Proposed Reservoir Expansion

Alternative B is the proposal to raise and improve the existing dams and expand the reservoir from its current storage capacity of 1,842 AF to 4,122 AF (an increase of 2,280 AF). This alternative would result in both short and long-term, as well as direct and indirect impacts to dam safety and flood hazard.

Under Alternative B, an upstream raise design has been proposed for the enlargement of the main dam. This construction technique would result in the reduction of the quantity of fill materials and a decrease in the amount of seepage through the existing embankment. Additionally, to minimize seepage through the main dam embankment foundation and the underlying bedrock, a positive cutoff trench and a grout curtain in bedrock has been incorporated into the final design (WCC, 1992b). These construction methods would result in a safer dam structure.

TABLE 4-1
RESULTS OF DAMBREAK ANALYSIS FOR FISH CREEK RESERVOIR

Location	Alternative A - No Action			Alternative B - Proponent's Proposal			Alternative C - Small Reservoir Expansion		
	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)
Fish Creek Downstream of Dam	63,200	12	0.9	136,200	16	0.7	80,400	13	0.7
Fish Creek @ Mt. Werner Water Treatment Plant	41,000	17	1.1	103,700	23	0.9	61,300	19	0.9
Fish Creek @ Highway 40	35,000	20	1.3	89,200	28	1.0	52,700	23	1.0
Yampa River @ Highway 40	26,200	11	1.7	69,400	16	1.2	41,200	13	1.3
Yampa River @ 2nd Street	25,800	11	1.7	68,100	16	1.2	40,500	23	1.3
Yampa River @ Riverside Drive	20,800	10	1.9	56,900	13	1.4	33,900	11	1.[illegible]

Note: [1]Cumulative time from beginning of dam failure to peak flow

(From Dambreak Analysis for Fish Creek Dam Enlargement, WCC 1992)

A high level outlet has also been proposed under Alternative B to allow a greater volume of water to be discharged from the reservoir. This outlet would be founded on bedrock near the left abutment and water would be discharged through a baffled outlet near the base of the dam. This outlet structure could be utilized to maximize the release of water from storage during potentially dangerous, high-flow situations. Also under Alternative B, the saddle dam would be removed and re-constructed to allow for a better foundation and to improve seepage control, thus improving the safety and integrity of the saddle dam. In addition, a new spillway would be constructed in bedrock on the right abutment of the new saddle dam, which would channel flows into the Puppy Dog Lake drainage during peak runoff periods. This is discussed further in Section 4.3, Water Resources.

During construction, short-term impacts would occur and would generally be associated with the draining of the reservoir. Activities such as dewatering for foundation excavations, earthwork construction, and structure foundations, would result in direct impacts to the shallow groundwater conditions. Seepage conditions and flood hazard conditions, however, would be eliminated during the short-term construction stage because Fish Creek Reservoir would be drained and would have no storage during this period.

Flood hazard potential downstream of the proposed dam enlargement due to catastrophic dam failure has been analyzed by Woodward-Clyde (WCC, 1992c) and is presented in Appendix F. Peak flow discharges immediately downstream of Fish Creek Reservoir would be 136,200 cfs, an increase of 73,000 cfs over the No Action Alternative. As a result of this increase, the downstream consequences associated with a dam failure would be increased. The peak depth on Fish Creek at the water treatment plant would be 23 feet at 0.9 hours after dam failure. A flood wave of 28 feet would occur on Fish Creek at Highway 40 at 1.0 hour after dam failure. The peak depth on the Yampa River at Riverside Drive would be 13 feet at 1.4 hours after dam failure. Table 4-1, Results of Dambreak Analysis for Fish Creek Reservoir, presents the peak flow, peak depth and elapsed time from dambreak for each of the three alternatives.

However, due to improved construction techniques and materials, the dam would have improved static and dynamic stability, and therefore, would be a safer structure. Alternative B includes the installation of an early warning monitoring system that would use survey monuments, piezometers, and weirs installed in the main and saddle dams to monitor and check the design criteria. This instrumentation would be incorporated into the early warning and automated data acquisition system (WCC, 1992b). This system would provide the information to alert City officials of direct impacts to the dam embankments so that conditions, which might otherwise go undetected, could be addressed before a catastrophic failure occurred. By responding early to dam conditions, corrective dam maintenance measures could be taken, and/or the Emergency Preparedness Plan (Appendix E) could be implemented.

Due to the relatively high density of the embankment materials and shallow foundation soils, the deformation due to static and dynamic (earthquake) loads is expected to be small and within acceptable limits.

4.2.2.3 Alternative C - Smaller Reservoir Expansion

In the early 1980's the City of Steamboat Springs evaluated three alternative increases in the storage capacity of the existing Fish Creek Reservoir, which included a 908 AF increase, a 2,000 AF increase, and a 3,050 AF increase (D&D, 1983). The 908 AF increase is referred to as Alternative C, Smaller Reservoir Expansion. According to a review of the conceptual design elements of this alternative (D&D,1983), Alternative C would have similar direct and indirect impacts as those discussed under

Alternative B. Indirect downstream impacts, though, would be less than those associated with Alternative B, due to a reduction in the storage capacity of the reservoir. Peak flow discharges would increase to 80,400 cfs (see Table 4-1). This represents a 17,200 cfs increase over the No Action Alternative and a 55,800 cfs decrease over the proposed reservoir expansion. A peak depth on Fish Creek at the water treatment plant would be 19 feet at 0.9 hours after dam failure. A flood wave of 23 feet would occur on Fish Creek at Highway 40 at 1.0 hour after dam failure. The peak depth on the Yampa River at Riverside Drive would be 11 feet at 1.5 hours after dam failure.

4.2.2.4 Borrow Sites, Access Roads, and Power Supply

As part of the construction of either Alternative B or C, one or more borrow sites would be utilized. Three borrow areas (A-1, A-2, and B) have been designed for development under Alternatives B or C. Short-term direct impacts which would occur during construction include lowering the shallow groundwater table, which is estimated to be 3 and 19 feet, through dewatering. Riprap requirements would be satisfied with rock from Borrow Areas A-1 or A-2. Blasting of the bedrock would be required to attain the proper riprap size. Indirect impacts associated with blasting the riprap source would include the potential generation of flyrock, noise, and vibrations. Since the borrow areas would be submerged during operation, indirect impacts resulting from the operation of borrow sites during construction are considered negligible.

Under Alternative B or C, one of the three optional dam access routes would have to be utilized during construction to carry materials to the construction site. The access road would also have to be utilized during dam inspections after construction is completed. A further discussion of road impacts is presented in Section 4.10, Transportation.

Under Alternative B or C, one of three optional power sources would be utilized for construction and for the operation of the early warning and remote operational control systems. The underground electrical supply source is the most reliable of the three optional power sources. Power requirements are such that neither the propane nor the solar options could reliably produce sufficient power to operate the outlet valve and the early warning and remote operational control systems.

4.2.3 Cumulative Impacts

Cumulative impacts to dam safety and flood hazards associated with the Alternative A would occur as a result of future development within the flood inundation area identified in Section 3.2. Increased development downstream of the Fish Creek Reservoir would elevate the likelihood of loss of property and life in the event of dam failure.

If Alternative B is combined with potential future development within the flood inundation area (See Section 3.2), cumulative impacts would include an increase in the potential downstream consequences involving loss of property and life. These impacts would be balanced to a certain degree, however, by the proposed increases in dam safety (including improved construction techniques and materials, and the installation of an early warning system).

Cumulative impacts associated with Alternative C would be similar to those of Alternative B, although the volume of water which would be released in the event of a dam failure under Alternative C would be reduced.

4.2.4 Mitigation and Enhancements Summary

Essentially, the mitigation necessary to ensure dam safety and reduce potential flood hazards would be incorporated into the final designs of Alternatives B or C.

4.2.5 Unavoidable Adverse Impacts

Unavoidable adverse dam safety/flood hazard impacts associated with the implementation of Alternative A include the continued operation of the dam in the absence of early warning and remote operational control systems. The downstream consequences of a dam failure would remain the same.

If Alternative B or C is implemented, the current reservoir would be expanded. This expansion would increase the storage capacity of the reservoir and would, therefore, increase the downstream consequences associated with a dam failure. The downstream consequences of a dam failure would be greater under Alternative B than under Alternative C since the proposed reservoir storage capacity is greater under Alternative B. This unavoidable adverse impact would be balanced to a certain degree, however, by the improved dam design and construction techniques, and by the installation of an early warning system which is proposed under both Alternatives B and C.

4.3 WATER RESOURCES

4.3.1 Introduction

Alternatives A, B and C are described below in terms of the physical characteristics of the dam and reservoir, the availability of water to fill the reservoir annually, construction sequencing, operational differences between alternatives, problems associated with erosion and sedimentation, and water rights. Additionally, impacts associated with water quality, water demand, and reservoir storage requirements are discussed.

4.3.2 Direct and Indirect Impacts

4.3.2.1 Alternative A - No Action

Alternative A, the No Action Alternative, assumes that the City would continue to operate Fish Creek Reservoir as it is presently operated. Section 3.3, Water Resources describes the physical characteristics of the reservoir, and its operation.

<u>Physical Characteristics</u> - Under the No Action Alternative, the physical characteristics of the reservoir would remain the same. To summarize, the existing Fish Creek Reservoir has a storage capacity of 1,842 AF and a surface area of approximately 90 acres. The main dam is 650 feet in length, and has an embankment crest elevation of 9,874 (55 feet high). The saddle dam is 400 feet in length, and has an embankment crest of 9,871.5 feet (16 feet high). Water supply from the Upper Middle Fork of Fish Creek and Granite Creek is sufficient to fill the reservoir at its present capacity (1,842 AF) in both an average flow year (7,723 to 8,560 AF) and during a 25-year low flow year (3,570 AF). See Section 3.3, for a description of how available water supply flows were estimated.

<u>Construction Plan</u> - There would be no construction activities under Alternative A.

Operation Plan - Under Alternative A, there would be no change in the operation of the reservoir. Fish Creek Reservoir, as it is currently operated, fills to capacity during the spring snowmelt runoff period with water from the Upper Middle Fork of Fish Creek and Granite Creek by the end of May or beginning of June. When the reservoir reaches capacity, there is flow through the spillway into the Puppy Dog Lake drainage. As described in Section 3.3, Water Resources, there has been considerable erosional damage from flows released through the spillway exceeding the carrying capacity of this smaller drainage basin. In July, the outlet works at the main dam are manually adjusted and flows are released to the Middle Fork of Fish Creek. Downstream of the confluence of Middle Fork Fish Creek with the Puppy Dog Lake drainage, the channel condition returns to normal within approximately 0.25 miles. Under Alternative A, this erosional process would continue, unless corrective action is taken by the Forest Service.

Water Rights - There would be no change in the administration of water rights in the Fish Creek drainage basin under Alternative A. Existing water rights have been described in detail in Section 3.3, Water Resources.

Water Demand/Reservoir Storage Requirements - Under the No Action Alternative, future (2010) water demand would exceed available water supply. The City would have barely enough water to meet their future demand, assuming no conservation pool. If a conservation pool would be required, the City could not meet future demands. Mt. Werner presently has no storage water rights and cannot meet present water demands. Mt. Werner would have to develop additional water supplies to meet present and future water demands and/or implement water restrictions and conservation methods. Under Alternative A, Mt. Werner would have to develop, at a minimum, 940 AF/year of additional supply. If the two entities (the City and Mt. Werner) consolidate, at least 492 AF/year of additional water supply would have to be developed, assuming that a conservation pool would not be required. If a conservation pool is required, a larger volume of supply would be necessary.

Water Quality - As stated previously, Mt. Werner would have to develop additional water supplies under Alternative A. These additional water supplies might not be equal to the Fish Creek supply in terms of water quality. Dependent upon the quality of the supply, extensive treatment might be required.

Under Alternative A, the erosional damage to Puppy Dog Lake drainage, and the subsequent downstream sedimentation, would continue unless corrective action is taken by the Forest Service.

Cumulative water quality impacts associated with increased recreational use of Fish Creek Reservoir are discussed in Section 4.3.3

4.3.2.2 Alternative B - Proposed Reservoir Expansion

Physical Characteristics - Alternative B is a 2,280 AF expansion of the present Fish Creek Reservoir. The total capacity of the reservoir under Alternative B would be 4,122 AF covering 140 acres. This represents an increase in surface area of approximately 50 acres. The main dam length would be 830 feet (an increase of 180 feet), and the height would be 75 feet (an increase of 20 feet). The saddle dam would be increased in length to 1,060 feet (an increase of 660 feet), and the height would be 40 feet (an increase of 24 feet). Water supply from the Upper Middle Fork of Fish Creek and Granite Creek would be sufficient to fill the proposed reservoir expansion during average years. However, during a 25-year low-flow period, the 3,570 AF available as inflow would fall 550 AF (or approximately 13 percent) short of filling the 4,122 AF reservoir, assuming that the reservoir was totally empty prior to spring runoff.

Construction Plan - Construction under Alternative B is anticipated to occur over two construction seasons. During the first construction season activities would include mobilization, borrow area drainage, excavation of borrow materials, removal of the saddle dam, partial construction of the main dam raise, modifications to the existing outlet works, construction of the high level outlet works, and stream diversion for the upper tributaries (WCC, 1992a). The saddle dam would be breached after the spring runoff flows occur in May and early June, and after the reservoir is drawn down to the base of the existing saddle dam. When the saddle dam is breached, stream flow from the Upper Middle Fork of Fish Creek and Granite Creek would be diverted through the breached dam into the Puppy Dog Lake drainage. Average monthly flows that occur in the summer months after spring runoff (July through September) in the Upper Middle Fork of Fish Creek over the period of record October, 1984 to September, 1991 range from 0.35 cfs during September to 2.34 cfs during July. Average monthly flows during July through September in Granite Creek over the same period of record range from 0.92 cfs in September to 6.24 cfs during July. Flows of this magnitude would not result in additional erosional damage to the Puppy Dog Lake drainage. The Proponent would finance a Forest Service position to oversee the implementation of this alternative and monitor the project during construction and thereafter.

During the second construction season, the existing outlet and the high level outlet works would be operational so that the diversion channel would be removed and flow would be directed through the main stem of the Middle Fork of Fish Creek. Work would then be completed on the saddle dam.

Erosion and sedimentation control measures, utilizing best management practices, would be required throughout the construction period by both the Forest Service and the WQCD. Additionally, stream monitoring would be required.

Operation Plan - The primary design goal for the proposed operation plan for Alternative B is to minimize potential erosional impacts to and degradation of the Puppy Dog Lake drainage. An additional goal of the proposed plan is to provide for the maintenance of in-stream flows. Implementation of this operating plan would utilize the additional outlet capacity of the proposed reservoir, the capability to operate the outlet structures remotely, and the ability to remotely monitor reservoir level and influent flows.

The capacity of the outlet structures in the proposed dam enlargement would increase from approximately 60 cfs to approximately 200 cfs. By allowing larger volumes of spring runoff to be released to the Middle Fork of Fish Creek, flows over the spillway may be delayed until after runoff is completed.

The remote telemetry system would monitor inflows from the Upper Middle Fork of Fish Creek and Granite Creek, the release rate of reservoir flows to the Middle Fork of Fish Creek through the outlet structures, and the reservoir level. The release rate could be remotely adjusted to allow complete filling of the reservoir to occur in late June, or early July, rather than early June.

Once the reservoir is filled, the outlet would be adjusted as necessary to ensure that spillway flows would not exceed 20 cfs. The operation plan could be modified if the maximum proposed spillway flow of 20 cfs was found to be inadequate for erosion protection in the Puppy Dog Lake drainage (Birch, 1992a). This would be determined through monitoring efforts.

Water Rights - As described in Section 3.3, Water Resources, two conditional water rights were filed by the City in anticipation of enlargement of the Fish Creek Reservoir. The first conditional storage right obtained in 1980 was for 2,000 AF. The second conditional storage right was filed in August

1992 for 200 AF. The Colorado Water Conservation Board (CWCB) objected to this filing on the basis that the Proponent's proposed reservoir expansion would inundate existing, minimum stream flow rights on the Upper Middle Fork of Fish Creek, and Granite Creek that are senior to the additional 200 AF. In a stipulation agreement between the City and the CWCB, CWCB recognizes that the City intends to release water from the 200 AF enlargement in order to maintain in-stream flows in downstream sections of Fish Creek, and that the City would develop a Donation Agreement. This agreement requires that the City construct habitat improvement structures in lower Fish Creek. The stipulation was formally adopted by both parties on December 31, 1992 and is presented in Appendix G.

<u>Water Demand/Reservoir Storage Requirements</u> - With the implementation of Alternative B, both the City and Mt. Werner would have sufficient water supply to meet present and future water demands. This would be the case whether or not the two entities would choose to consolidate. Additionally, under this alternative, approximately 1,100 AF of storage capacity would be available as a conservation pool. No additional future reservoir storage supplies would have to be developed.

<u>Water Quality</u> - With the implementation of Alternative B, the community would continue to receive high quality water from the Fish Creek Basin. The development of additional water supplies would not be necessary.

Temporary water quality impacts at the site could occur during construction activities in the form of increased sedimentation. Best management practices, however, would be utilized during construction to minimize erosion, sedimentation, and the subsequent increase in stream turbidity and suspended solids. Additionally, stream monitoring would be required. During construction, there would also be the potential for petroleum based contamination from heavy equipment leaks and/or spills. A spill prevention and response plan would be required within the construction operating plan.

Under Alternative B, the erosional process in Puppy Dog Lake drainage would be reduced. This would result in a decrease in downstream sedimentation.

With the implementation of Alternative B, the existing vault toilet, which is no longer functional, would be replaced with a composting toilet. Utilization of a composting toilet would protect the water quality of the reservoir by preventing the introduction of untreated wastewater.

The construction of a potable water system under Alternative B would provide recreationists at the reservoir with a safe drinking water supply meeting the requirements of the Safe Drinking Water Act.

Under Alternative B, approximately 50 acres of land would be inundated. Most of this area would be within borrow areas, and thus would not be vegetated at the time of inundation. Small areas of vegetation, however, would be inundated. Given the short growing season at the reservoir site, the existing highly oxygenated, high quality water source, and the minor extent of vegetation to be inundated, water quality impacts associated with inundation are expected to be negligible.

Cumulative water quality impacts are discussed in Section 4.3.3.

4.3.2.3 Alternative C - Smaller Reservoir Expansion

Physical Characteristics - Alternative C would be a 908 AF expansion of the existing Fish Creek Reservoir. The total capacity of the small scale reservoir would be 2,750 AF covering 112 acres (an increase in surface area from the existing reservoir of approximately 22 acres). The main dam length would be 750 feet (an increase of 100 feet), and the height would be 63 feet (an increase of 8 feet). The saddle dam would be increased in length to 800 feet from 400 feet, and the height would increase to 26 feet from 10 feet. Water supply from the Upper Middle Fork of Fish Creek and Granite Creek would be sufficient to fill the small scale enlargement during average years, as well as the 25-year low flow period.

Construction Plan - The construction plan for Alternative C would be the same as for the Alternative B. Two construction seasons would still be required, and a diversion structure for the Upper Middle Fork of Fish Creek and Granite Creek would be required during the first construction season.

Operation Plan - The operation plan for Alternative C would be the same as for Alternative B, resulting in a decrease in erosion and sedimentation impacts in the Puppy Dog Lake drainage from the current reservoir operation.

Water Rights - The additional storage capacity of Alternative C is 908 AF. This additional amount of storage could be exercised under the conditional storage right of 2,000 AF. The stipulated agreement between the City and CWCB would not be pertinent since the additional 200 AF storage right would not be exercised under this alternative.

Water Demand/Reservoir Storage Requirements - With implementation of Alternative C, the City could meet its present and future water demands. Alternative C, however, would not meet the projected future demands of the Mt. Werner district. Mt. Werner would have to develop additional supplies of approximately 260 AF/year to meet future demands. If the two entities were to combine, Alternative C would barely meet future demands. Future demands would not be met for the consolidated water utility if a conservation pool is required to maintain fisheries.

Water Quality - As stated previously, under Alternative C, Mt. Werner would have to develop an additional water supply and/or impose water restrictions and conservation to meet future demands. The additional water supply could be of inferior water quality to the Fish Creek supply.

Additional water quality impacts associated with the implementation of Alternative C are the same as those discussed under Alternative B.

4.3.3 Cumulative Impacts

Increased recreational use of Fish Creek Reservoir and the continued use of the adjacent area for sheep grazing, could result in minor water quality impacts to the reservoir. Of concern are potential increases in the presence of fecal coliform (from humans and/or animals) and runoff of petroleum products from cars into the reservoir. According to the Forest Service, grazing is not permitted within 500 feet of the reservoir.

Cumulative impacts associated with a reduction in water demand (resulting from the implementation of water conservation measures) would include cost savings associated with the decrease in water and wastewater treatment volumes. Water and wastewater treatment operation and maintenance costs

would be reduced and costly treatment plant expansions could be avoided. Additionally, infrastructure capital and operation costs associated with the distribution of water and collection of wastewater could be reduced. With a metered billing rate, however, a reduction in water demand could also result in decreased revenues.

4.3.4 Mitigation and Enhancement Summary

Mitigation of the erosional damage to the Puppy Dog drainage is suggested for all three alternatives. Future degradation of this drainage would be prevented with the implementation of Alternatives B or C. Under the No Action Alternative, the Forest Service would make a determination as to the steps necessary to correct this concern.

Erosion control mitigation and stream monitoring during construction activities is recommended for the two action alternatives (B and C) to prevent stream sedimentation and preserve stream water quality. A spill prevention and response plan would also be required within the construction operating plan.

Additionally, a conservation pool is recommended to maintain fisheries, visual resources, and the recreational atmosphere at Fish Creek Reservoir. This conservation pool could be used as a back-up water supply during extreme drought years.

4.3.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts associated with Alternative A include the continued degradation of the Puppy Dog channel, insufficient availability of the Fish Creek water supply for the Mt. Werner district, the potential development of inferior water supplies for Mt. Werner, and no remote operational control systems.

No unavoidable adverse water resource impacts are associated with Alternative B.

Unavoidable adverse impacts associated with Alternative C include insufficient availability of the Fish Creek water supply for the Mt. Werner district and the potential development of inferior water supplies for Mt. Werner.

4.4 SOCIOECONOMICS

4.4.1 Introduction

Potential socioeconomic impacts associated with the Alternatives A, B, and C are presented in this section. Potential direct and indirect impacts are discussed under the broad general categories of socioeconomic climate, public safety, water utility rates, and reservoir financing.

4.4.2 Direct and Indirect Impacts

4.4.2.1 Alternative A - No Action

Socioeconomic Climate - Alternative A could impact the socioeconomic climate of the community if a supplemental water source is not obtained for Mt. Werner. The lack of water resources could potentially limit growth. If water resources become limited to the extent that they restrict growth in Mt. Werner, the cost of living in the community could increase. In addition, if a lesser quality

water source than Fish Creek is obtained, some community members would have to rely on this lesser quality water which could cause dissatisfaction.

Public Safety - As discussed in Section 4.2, under Alternative A, due to engineering constraints, no early warning system would be installed to warn the community in the event of a dam failure. Furthermore, no remote control system would be installed to allow the City to respond to uninitiated changes in dam operation. Potential flood impacts associated with the No Action Alternative are presented in Section 4.2.

Water Utility Rates - Mt. Werner has recently changed, and the City is in the process of changing to metered rate structures, as discussed in Section 3.4. No further rate changes beyond those discussed are anticipated for either the City or Mt. Werner under Alternative A.

Reservoir Financing - Alternative A would not have a reservoir financing program. The resolution passed by City Council for reservoir financing would be void. A loan has already been secured for the proposed reservoir expansion by Mt. Werner. This loan was applied for in advance of a Forest Service decision, in the interest of the City and Mt. Werner, in order to capture low interest rates to the benefit of the community. Selection of the No Action Alternative would cause the Proponent to make penalty interest payments of approximately $80,000 per year, until a decision is made or the Special Use Application. The interest payment would be a loss, since nothing would be built, and the loan would be returned.

Neither Mt. Werner nor the City would further increase water rates or increase property taxes to pay for the proposed expansion. Mt. Werner would pay for its portion of the proposed $6,000,000 expansion through user fees and a City rebate and the City would likely pay for its share through general fund sales tax revenues. For both Mt. Werner and the City, these funds would be available for other purposes if the No Action Alternative is selected. Mt. Werner would likely utilize the money for the development of an alternate water supply source and/or the construction of other capital improvement projects. Since the City's portion of the payment would likely be coming from the general fund, the City Council would re-prioritize its capital improvement projects. The money would not necessarily go towards water utility projects (Birch, 1992d).

4.4.2.2 Alternative B - Proposed Reservoir Expansion

Socioeconomic Climate - As discussed in Section 3.4, water availability in Steamboat Springs has not promoted or prevented growth in the community. Rather, it has enabled normal growth patterns to proceed. Under Alternative B, this trend would continue since water would not be a limiting resource to growth.

Public Safety - As discussed in Section 4.2, under the Proposed Action, an early warning system would be installed to warn the community in the event of a dam failure. Furthermore, a remote control system would be installed to allow the City to respond to uninitiated changes in dam operation. Potential flood impacts associated with Alternative B are greater than those associated with the No Action Alternative as discussed in Section 4.2, but the likelihood of dam failure would be less, based on design and modern construction methods.

Water Utility Rates - As discussed previously, Mt. Werner has recently changed, and the City is in the process of changing to a metered rate structure. No further rate changes beyond those discussed are anticipated for either the City or Mt. Werner under Alternative B.

Reservoir Financing - Under the proposed reservoir financing strategy, discussed in Section 3.4, Mt. Werner would pay for 75 percent and the City would pay for 25 percent of the total reservoir expansion costs of approximately $6,000,000. (This equates to a unit cost of approximately $2,600 per AF of storage, compared to the unit cost of $4,600/AF under Alternative C.) The water storage capacity received by each entity would be proportional to the share of the project for which each entity pays.

Neither Mt. Werner nor the City would increase water rates beyond the recent (Mt. Werner) and proposed (City) rate changes or increase property taxes to pay for the proposed expansion. Mt. Werner would pay for its portion of the proposed $6,000,000 expansion through user fees and a City rebate and the City anticipates that it would pay for its share through general fund sales tax revenues.

Mt. Werner would fund approximately 23 percent ($1,370,000) of the total cost up front from its reserve funds. The remainder of the project ($4,630,000) would be funded with a 20-year loan from the Colorado Resources and Power Development Authority. Mt. Werner would begin to repay the loan immediately, while the City would begin to repay their share of the loan in eight years. This arrangement is appropriate since Mt. Werner's need for storage capacity is immediate and the City does not need additional storage capacity in the near future.

4.4.2.3 Alternative C - Smaller Reservoir Expansion

Socioeconomic Climate - As with Alternative A, the lack of water resources could potentially limit growth in the future under Alternative C. As discussed previously, if water availability begins to restrict growth, the cost of living in the community could increase. Additionally, under this alternative, the community might have to rely upon water sources of lesser quality.

Public Safety - Under Alternative C, an early warning system would also be installed to warn the community in the event of a dam failure. Furthermore, a remote control system would be installed to allow the City to respond to uninitiated changes in dam operation. Potential flood impacts associated with the Smaller Reservoir Expansion Alternative are greater than those associated with the No Action, and less than those associated with the Proposed Action as discussed in Section 4.2. However, the likelihood of dam failure would be reduced by the design and operation of the reservoir.

Water Utility Rates - As discussed previously, Mt. Werner has recently changed, and the City is in the process of changing, to metered rate structures. No further rate changes beyond those discussed are anticipated for either the City or Mt. Werner under Alternative C.

Reservoir Financing - A similar financing arrangement would be developed for Alternative C as that discussed for Alternative B. Mt. Werner and the City would share in the total reservoir expansion costs of approximately $4,200,000. This equates to a unit cost of approximately $4,600 per AF of storage, which is higher than the unit cost for implementing Alternative B. While the overall cost of Alternative C is lower than the cost of Alternative B, the cost per AF of storage is higher by approximately 77 percent. The water storage capacity received by each entity would be proportional to the share of the project for which each entity pays. Additional water supplies would have to be developed, however, to meet the projected future (2010) demands of Mt. Werner.

Neither Mt. Werner nor the City would increase water rates or increase property taxes to pay for Alternative C. Mt. Werner would pay for its portion of the $4,200,000 expansion through user fees and a City rebate and the City would pay for its share through general fund sales tax revenues.

For both Mt. Werner and the City, this $1,800,000 difference between the proposed and smaller reservoir expansions would be available for other purposes if Alternative C is selected. Mt. Werner would likely utilize the money for the development of a different water supply source and/or the construction of other capital improvement projects. Since the City's portion of the payment would be coming from the general fund, the City Council would likely re-prioritize its capital improvement projects. The money would not necessarily go towards water utility projects (Birch, 1992d).

4.4.3 Cumulative Impacts

With additional growth in the community, an eventual expansion of the water and wastewater treatment facilities is likely under all three alternatives. With growth comes an increase in water demand and the subsequent increase in wastewater loadings. These increases result in the need to expand the capacity of treatment facilities. Other infrastructure, such as water distribution and wastewater collection lines, may also require expanded capacity.

Cumulative impacts associated with a reduction in water demand (resulting from implementation of conservation measures) could include cost savings associated with the decrease in water and wastewater treatment volumes. Water and wastewater treatment operation and maintenance costs would be reduced and costly treatment plant expansions could be avoided. Additionally infrastructure capital and operation costs associated with the distribution of water and collection of wastewater could be reduced. With a metered billing rate, however, a reduction in water demand could also result in decreased water and wastewater utility revenues.

Growth pressures continue in Routt County, especially south of Steamboat Springs. Several major developments are in various stages of planning, including the Alpine Land, Sydney Peak, and Catamount developments. As discussed in Section 3.4, continued growth in the area is expected to impact the present socioeconomic climate and quality of life experienced by the community.

4.4.4 Mitigation and Enhancement Summary

Possible mitigation includes the implementation of water conservation programs. Costs associated with water storage and construction of additional treatment capacity could potentially be reduced.

Additional mitigation includes the development of comprehensive 20-year water system master plans and wastewater system facility plans for the City and Mt. Werner. Water and wastewater utility system planning would define a service area and evaluate the most cost-effective water and wastewater system capital improvements required by the City and Mt. Werner to meet future needs within that service area. Additionally, such planning would allow for the thorough analysis of facility alternatives, institutional arrangements and cost distribution possibilities for future water and wastewater system development.

4.4.5 Unavoidable Adverse Impacts

Unavoidable socioeconomic adverse impacts under Alternative A would include the annual penalty interest payment of $80,000 until the time that a decision is made on the Special Use Application. If the lack of water restricts growth in the community, the cost of living in the community could

increase. Additionally, under Alternative A, some community members might have to rely upon a water source of lesser quality. Under Alternative A, the absence of an early warning system and remote operational control systems would continue, as discussed previously in Section 4.2, unless corrective action is taken by the Forest Service.

Under Alternative B, Mt. Werner would pay for 75 percent and the City for 25 percent of the proposed $6,000,000 reservoir expansion project.

Under Alternative C, the cost of living in the community could increase if the lack of water restricts growth. Additionally, the community might have to rely upon a water source of lesser quality than the Fish Creek source. Mt. Werner and the City would share in the cost of the $4,200,000 Alternative C expansion.

4.5 WETLANDS

4.5.1 Introduction

The following text presents a discussion of potential impacts to the wetlands resource. The impacts identified are those which can be expected to occur as a result of the proposed activities and alternatives detailed in Chapter 2. The potential for successful mitigation of impacts to wetlands is also discussed. Table 4-2, depicts the total acreages to be directly impacted by the various alternatives.

TABLE 4-2
WETLAND ACREAGE TO BE IMPACTED BY ALTERNATIVE

	Acreage Inundated	Acreage Filled
ALTERNATIVES		
Alternative A - No Action	0.00	0.00
Alternative B - Proposed Reservoir Expansion	15.00	0.00
Alternative C - Smaller Reservoir Expansion	8.80	0.00
BORROW AREA OPTIONS		
Borrow Area A-1 (Alternative B)	12.30*	0.00
Borrow Area A-1 (Alternative C)	6.60*	0.00
Borrow Area A-2	0.00	0.00
Borrow Area B	0.00	0.00
CAMPGROUND RELOCATION SITE OPTIONS		
Campground Relocation Site 1	0.00	0.00
Campground Relocation Site 2	0.00	0.00
Powerline	0.00	0.09
ROAD CORRIDOR OPTIONS		
Road Option #1	0.00	0.00
Road Option #2	0.00	0.37
Road Option #3	0.00	0.48
*Acreage included in corresponding reservoir expansion shoreline inundation		

4.5.2 Direct and Indirect Impacts

4.5.2.1 Alternative A - No Action

Under Alternative A, the project area would essentially remain in its existing state, supporting current land uses. The total acreage of wetlands and the characteristics of the plant communities would not likely change significantly in the future, barring any unforeseen site developments or alterations in recreation or grazing policy.

4.5.2.2 Alternative B - Proposed Reservoir Expansion

Under Alternative B, the primary impact to the wetlands resource would be the inundation of a portion of the wetlands surrounding the reservoir as a result of the planned increase in storage capacity. This inundation is a form of "filling" and is, therefore, considered to be an impact to be addressed. A total of approximately 15.09 acres of wetlands would be affected as a result of this Alternative. This acreage includes the wetland area to be inundated by the increased storage capacity (15.00 acres) which includes wetlands within Borrow Area A-1. Approximately 0.09 acres would be disturbed by the proposed powerline construction. Campground Relocation Sites 1 and 2 would not directly effect any wetlands. Inundation and filling are considered to be direct, long-term impacts resulting in the permanent loss of the wetlands affected.

It should be noted that the avoidance of wetlands was incorporated into the design of the Proposed Action. Utilization of an upstream, rather than a downstream raise would avoid the filling of additional wetlands on the downstream side of the dam.

As a part of the proposed reservoir operation, discharges from the saddle dam through the Puppy Dog Lake spillway downstream would be reduced from higher historical levels to maximum discharges of approximately 20 cfs. Concern exists for the fate and dependence on historical flows of the wetlands located around the lake and along the drainage downstream.

Puppy Dog Lake is a natural lake that is thought to have formed from natural drainage, and possibly spring seep, prior to the construction of Fish Creek Reservoir. Saddle dam seepage and the yearly high flows released into the lake following reservoir construction have affected the development of wetlands around the lake circumference. The degree to which this has occurred and extended the historical wetland boundaries, if at all, is unknown. As a part of the Proposed Action, the saddle dam to be constructed would also be designed to seep, though not to the degree that the existing dam seeps, and flows through the lake would be reduced. The effect this Proposed Action will have on wetlands existing around the lake is unknown at this time. It is known that Puppy Dog Lake, given its natural position, will remain following construction and that wetlands will surround the lake shore and be fed by saddle dam seepage and planned discharges. It is reasonably certain that the wetland acreage would not increase as a result of the Proposed Action. The wetland acreage could, therefore, remain constant due to the natural position and hydrology of the lake itself, or decrease somewhat due to the reduction in flows to be released through the reservoir during the early spring. It is most likely that any wetlands to be lost would be those of a more transitional nature (to upland conditions) and be located upslope from the lake shoreline. However, the overall net effect to wetlands due to the Proposed Action cannot be quantified at this time given existing data.

With regard to the wetlands downstream from Puppy Dog Lake, it is believed that lower flows would not result in a loss of these wetlands. Higher historical flows were extremely brief in nature and are not thought to be the basis upon which these wetlands developed. It is assumed that these wetlands developed primarily as a result of subirrigation and flooding due to normal flows through the channel. Though it has not been quantified, lower flows should serve to support the existing wetlands through continuing natural creek overflow and subirrigation processes.

One positive indirect impact may occur to the wetland resource as a result of Alternative B. Though the basic effect of inundation is a loss of wetlands, some wetlands surrounding the proposed new high waterline, may naturally form as a result of inundation in the same manner as some of the existing wetlands formed. The potential for this to occur and the characteristics those wetlands would assume, cannot be accurately quantified at this point in time.

4.5.2.3 Alternative C - Smaller Reservoir Expansion

A total of approximately 8.80 acres of wetlands would be affected under Alternative C as opposed to the 15.00 acres under Alternative B. The type and duration of this impact is considered to be the same as for Alternative B, with the exception that fewer wetland acres would be affected. Other impacts and the potential effectiveness of the proposed mitigation plan are the same for this alternative as for Alternative B, with one exception. With fewer impacted wetland acres to mitigate for, a more selective approach might be possible with regard to choosing areas where upland/wetland conversions were employed, possibly resulting in a somewhat higher conversion success potential.

4.5.2.4 Borrow Area Options

Three borrow area options are being considered as a part of this project. The Borrow Area A-1 option would affect approximately 12.30 acres of wetlands under Alternative B and 6.60 acres of wetlands under Alternative C, which are also included in the area to be inundated by the alternatives (see Sections 4.5.2.2 and 4.5.2.3). This would result in a net impact to wetlands of 0 acres. No wetlands would be impacted by Options A-2 and B since both of these areas consist entirely of uplands.

4.5.2.5 Campground Relocation Site Options

No wetlands would be affected as a result of the construction of the Campground Relocation Sites 1 or 2.

4.5.2.6 Road Corridor Options

Three road corridor options have been identified for this project. Road construction would result in the filling of various wetland acreages, depending upon the option, to create the required roadbed to achieve transportation objectives. The wetland acreage to be impacted by Road Corridor Options 1, 2, and 3 are 0.04, 0.37, and 0.48 acres, respectively. The acreage to be filled during construction under the option eventually selected would be included in the acreage to be mitigated for under the proposed wetland mitigation plan. Assuming wetland mitigation is successful, there would be no net loss of wetlands as a result of this project.

4.5.3 Cumulative Impacts

No wetland cumulative impacts have been identified.

4.5.4 Mitigation and Enhancements Summary

The Proponents have submitted a wetland mitigation plan (IME, 1992) to compensate for the wetlands to be lost as a result of project activities. It is proposed that "on-site, in kind" wetland creation activities serve as the basis of mitigation with off-site wetlands purchase/preservation a potential alternative mitigation procedure. Wetlands would be created by modifying and revegetating existing upland sites at a ratio of 1.50 acres of created wetlands to 1.00 acres of wetlands disturbed by inundation or filling. Wetlands to be created would parallel the types of wetlands to be affected by project activities. "In kind" wetland mitigation would be based on the use of Corps of Engineer's accepted evaluation procedures. A total of approximately 42 acres have been identified as potential mitigation sites. These sites are, for the most part, located near or adjacent to existing wetlands lending credence to the theory that hydrologic conditions exist or can be modified to support an upland-wetland conversion program. The revegetation techniques included in the mitigation proposal, including salvage and reapplication (at wetland mitigation sites) of wetland soils to be inundated or filled, reflect a potentially and technically successful approach to wetland mitigation. Assuming a successful mitigation program, there should be no net long-term loss of wetlands as a result of Alternatives B or C.

4.5.5 Unavoidable Adverse Impacts

Wetlands affected due to inundation or filling would be permanently lost as a result of the implementation of either Alternative B or C. The wetland mitigation plan, as proposed and if successful, would mitigate for this resource loss.

4.5.6 Irreversible and Irretrievable Commitment of Resources

Wetlands inundated or filled would be permanently lost under Alternatives B or C.

4.6 SOILS

4.6.1 Introduction

The following text presents a discussion of potential impacts of the alternatives to the soils resource. The primary impacts that would occur include loss of soil productivity and an increase in the potential for erosion. Impacts to vegetation productivity, directly related to impacts to soil productivity, are treated in more detail in Section 4.7, Vegetation. Concerns related to potential erosion hazards for the soils impacted, are presented in the text in conjunction with a discussion of reclamation potentials.

Table 4-3 depicts the acreage of soil types to be directly affected by the project alternatives.

4.6.2 Direct and Indirect Impacts

4.6.2.1 Alternative A - No Action

Under Alternative A, the project area would essentially remain in its existing state. Future impacts to soils would parallel existing impacts. Natural erosion rates and soil productivities would mirror those occurring at this time, assuming that land management policies and uses of the project area do not change significantly in the future.

4.6.2.2 Impacts Common to All Action Alternatives

Impacts to the soil resource, under Alternatives B and C, include those which would affect the chemical and physical nature of the endemic soils as well as the volumes available for reclamation. Soil chemical and physical parameters would be permanently modified as a result of a soil reclamation program. Soil horizons would be mixed during salvage resulting in a blending of characteristics as compared to the soils in their natural state. Assuming that only soils suitable for reclamation would be salvaged, blending should not result in the degradation of soil resources in terms of reclamation potential. Soil chemistry would also be modified through soil stockpiling as anaerobic conditions within the stockpiles develop. Soil chemical changes due to stockpiling are considered to be short-term and redeemable to a level commensurate with adequate vegetation establishment following re-soiling. A soil sampling and analysis program should adequately address the soil chemistry concern and limit this impact to the short-term. Isolated spill accidents, should they occur, could result in minor soil contamination from oils, solvents, etc. Such spills would normally result in soils deemed unsuitable for reclamation. Soils so affected can be buried to effectively reduce the effects of this impact. The volume of soil subject to spills should be limited and no impact to revegetation potential would be anticipated.

TABLE 4-3
SOIL MAP UNITS IMPACTED BY ALTERNATIVE

	Map Unit Number			
	44	74	75	612C
ALTERNATIVES				
Alternative A - No Action	0.5	0.0	0.0	0.0
Alternative B - Proposed Reservoir Expansion	7.0	0.0	5.6	38.8
Alternative C - Smaller Reservoir Expansion	5.9	0.0	5.6	22.9
BORROW AREAS				
Borrow Area A-1 (Alternative B)*	0.5	0.0	8.8	27.4
Borrow Area A-1 (Alternative C)*	0.5	0.0	4.3	21.6
Borrow Area A-2	0.5	0.0	0.0	2.5
Borrow Area B	0.1	13.5	0.0	1.5
CAMPGROUND RELOCATION SITE OPTIONS				
Campground Relocation Site 1	0.1	0.0	2.6	4.3
Campground Relocation Site 2	0.5	4.9	0.0	0.0
ROAD CORRIDOR OPTIONS				
Road Option #1	0.3	0.8	0.0	0.0
Road Option #2	0.3	0.6	0.5	0.2
Road Option #3	0.3	0.2	0.7	0.4
POWERLINE	2.0	0.0	0.0	0.2

*Acreage included in corresponding reservoir expansion shoreline inundation

4.6.2.3 Alternative B - Proposed Reservoir Expansion

Approximately 60.6 acres of soils would be directly impacted by either inundation, removal for fill, or surface disturbance as a result of Alternative B. Inundation would affect 51.4 acres as a result of increasing the reservoir storage capacity corresponding with a raised shoreline elevation. Included in this total are the 36.2 acres of disturbance associated with Borrow Area A-1. It is assumed that the majority of soils associated with Borrow Area A-1 would be used in the construction of the proposed dams and associated facilities thereby rendering a permanent loss of these soils in terms of vegetation productivity. The majority of the remaining 15.2 acres of soils would be inundated and similarly affected in terms of lost production. Construction of the proposed campground would impact a maximum of 7.0 acres of soils. Impacts would be limited to surface and upper subsurface soil horizons as a result of parking lot, trail, and camp site construction. Overall, the impacts to soils would be limited primarily to a permanent loss of a very small, but undetermined, acreage of soil productivity due to a change in land use. Soil erosion could occur to a very limited extent until surface disturbances were stabilized. Given that the revegetation potentials of the vast majority of soils to be affected (map units 44, 75, 612C) are "moderate" and the disturbances planned are small, soil erosion is considered to be a limited, short-term, mitigable impact.

A maximum of 2.2 acres of soils would potentially be disturbed as a result of powerline construction. Considering that soil disturbance would likely be limited to the trench in which the line is laid and the area immediately surrounding the trench, the acreage to be disturbed should be significantly less. Assuming that soil materials are returned to the trench as a part of the construction process, the impacts to soils are limited to a brief period of reduced productivity until the trench disturbance is revegetated.

4.6.2.4 Alternative C - Smaller Reservoir Expansion

A total of approximately 29.6 acres of soils would be affected under Alternative C as opposed to the 51.4 acres under the Alternative B. Discounting the 25.9 acres of borrow source soils discussed below under subsection 4.6.2.5, a net total of 3.7 acres of soils would be lost to inundation as compared to a net of 15.2 acres of soils under Alternative B. The type and duration of this impact, as well as the positive aspects of 8.8 acres of wetland soil salvage, is considered to be the same as for Alternative B with the exception that fewer acres of soils would be affected.

4.6.2.5 Borrow Area Options

Borrow Area A-1, under Alternative C, would affect approximately 25.9 acres of soils as compared to the 36.2 acres under Alternative B. These soils, with the exception of 6.6 acres of wetland surface soil materials, would be salvaged from the borrow site and used as fill during construction. The area from which the soils were removed would then be inundated. The productivity of the soils to be affected would be permanently lost. The small volume of salvaged wetland soil material would be used to aid in mitigating the loss of wetlands. As such, the productivity potential of this material would be retained. Borrow Area A-2 encompasses approximately 3.0 acres, of which the majority is rock outcrop. Borrow Area B consists of approximately 23.4 acres. A portion of this acreage was previously disturbed for fill materials at an earlier date and consists of a borrow pit undergoing natural revegetation. The Proponent has not submitted a revegetation plan, including a soil salvage and handling plan, for these borrow areas. Therefore, a discussion of the impacts to soil productivity and soil erosion potential, or an assessment of the potential for successful reclamation, is not possible at this time. The Proponents do indicate that these disturbances would be resoiled and seeded, but there is no information, especially in terms of soil volumetrics, to indicate that

sufficient soil would be salvaged and reapplied to disturbed areas to support a stable, productive, post-disturbance vegetation community. Therefore, it is assumed that the majority of the productivity of the endemic soils overlying the borrow areas (excluding rock outcrop areas) would be lost and that erosion would increase to an undefined degree over that occurring naturally.

4.6.2.6 Campground Relocation Site Options

Construction of Campground Relocation Site 2 would impact a maximum of 5.3 acres of soils as compared to the 7.0 acres under Campground Relocation Site 1 (see Figure 2-5). The impacts to Campground Relocation Site 1 would be limited to surface and subsurface soil disturbances resulting in a loss of soil vegetation production and a potential for limited erosion. The primary soil (Map Unit 74) to be affected under Campground Relocation Site 2 has a somewhat higher water erosion hazard and lower revegetation potential than the primary soils (map units 75 and 612C) to be affected under Campground Relocation Site 1 indicating a potential for greater (though very limited) soil losses due to erosion until surface stabilization is achieved.

4.6.2.7 Road Corridor Options

Soil acreage to be affected by Road Options 1, 2, and 3 are 1.4, 1.6, and 1.6 acres, respectively. Soil erosion hazards are somewhat higher, and revegetation potentials slightly lower, for Option 1 as compared to Options 2 and 3, due to the relative acreage of Map Unit 74 being affected among the road corridor options (see Table 4-3). Conversely, the predominance of the low productivity soils of Map Unit 74 along Road Corridor Option 1 as compared to the higher productivity soils of Road Corridor Options 2 and 3 indicate that less potential soil productivity would be lost as a result of the selection of Road Corridor Option 1. Given a regional perspective and assuming that Forest Service road stabilization and revegetation requirements are followed, there is little overall difference between road corridor options in terms of the effect to soil productivity and the potentials for soil stabilization.

4.6.3 Cumulative Impacts

No cumulative soil impacts have been identified.

4.6.4 Mitigation and Enhancements Summary

Surface soil horizons from approximately 8.8 (Alternative C) to 15.0 acres (Alternative B) to be inundated would be salvaged as a part of the wetland mitigation program and reapplied to wetland mitigation sites. The productivity value of the salvaged soils would be retained as a result of the reclamation program.

4.6.5 Unavoidable Adverse Impacts

Under Alternatives B and C, minor losses of soil materials suitable for revegetation would occur during salvage operations due to innate equipment inefficiencies. Soil erosion on regraded and resoiled areas would likely occur to a small degree, until vegetation has become fully established and reclamation is successful.

4.6.6 Irreversible and Irretrievable Commitment of Resources

Under Alternatives B and C, soil materials not salvaged for revegetation would be lost as a result of inundation, use as fill, or burial beneath the roadbed during road construction.

4.7 VEGETATION

4.7.1 Introduction

This section details the potential impacts of the project alternatives on the vegetation resources proximal to the existing reservoir. Measurable effects of the Proposed Action on vegetation resources more distant are not anticipated and, therefore, will not be addressed in this document. The impacts identified are those which can be reasonably expected to occur as a result of the implementation of alternatives detailed in Chapter 2. The direct effects of the project to one particular vegetation community, wetlands, is separately discussed in Section 4.5, owing to that community's particular importance with regard to Corps of Engineers permitting requirements.

Because the potential impacts to vegetation as a result of project evolution are directly related to physical disturbances, no adverse effects could be considered common to all alternatives with the exception of a small amount of disturbance due to powerline burial. However, two important conditions are common to all alternatives. These conditions are that no impacts are anticipated as a result of project construction and operation to: 1) threatened, endangered, or sensitive plant species, or; 2) to the grazing management of the area. These conditions exist due to the management of the grazing allotment (restriction of grazing etc. within 500 feet of the reservoir), and the fact that no sensitive species were discovered during intensive search efforts in the vicinity of the reservoir (see Section 3.7).

4.7.2 Direct and Indirect Impacts

4.7.2.1 Alternative A - No Action

Under Alternative A, the project area would remain in its existing state supporting current land uses. Impacts of the existing reservoir on the vegetation resources have already been realized and would not be expected to change in the foreseeable future barring any unforeseen site developments or alterations in recreation or grazing policy.

4.7.2.2 Alternative B - Proposed Reservoir Expansion

Assuming implementation of Alternative B, the primary impact to the vegetation resources would be the inundation of a portion of each of those communities proximal to the reservoir. The acreage which would be lost due to inundation is presented on Table 4-4, Potential Disturbed Acreage By Vegetation Type. Therefore, as noted in this table, 51.4 acres of vegetation would be lost as follows: 15.0 acres (29%) of wetland, 19.1 acres (37%) of upland meadow, 12.0 acres (23%) of mixed conifer, and 5.3 acres (11%) of previously disturbed ground. The proposed borrow source, area A-1, would affect 35.9 acres, however, about three-quarters of this acreage would be inundated. The remaining one-quarter, is predominantly upland meadow with some mixed conifer. Finally, the proposed powerline would potentially affect an additional 2.2 acres of vegetation located along the Fish Creek Access Road. Any of the three road corridor options would affect about one and one/half acres. In total, the proposal would disturb approximately an additional 71 acres of vegetation (including 5.5 acres of previous disturbance) over current conditions.

TABLE 4-4
POTENTIAL DISTURBED ACREAGE BY VEGETATION TYPE

	Wetlands	Upland Meadow	Mixed Conifer	Disturbed Areas	Total Acreage
ALTERNATIVES					
Alternative A - No Action	0.0	0.0	0.0	0.0	6.9
Alternative B - Proposed Reservoir Expansion	15.0	19.1	12.0	5.3	51.4
Alternative C - Smaller Reservoir Expansion	0.5	19.1	6.1	3.8	29.5
BORROW AREA OPTIONS					
Borrow Area A-1 - (Alternative B)	12.3	12.0	7.9	3.7	35.9
Borrow Area A-1 - (Alternative C)	6.6	19.1	6.1	2.2	25.8
Borrow Area A-2	0.0	0.7	2.3	0.0	3.0
Borrow Area B	0.0	9.5	13.7	0.2	23.4
CAMPGROUND					
Campground Relocation Site 1	0.0	3.3	3.6	0.0	6.9
Campground Relocation Site 2	0.0	0.5	[illegible]	0.2	5.3
ROAD CORRIDOR OPTIONS					
Road Option 1	0.04	0.24	1.21	0.00	1.49
Road Option 2	0.37	0.50	0.82	0.00	1.69
Road Option 3	0.48	0.40	0.71	0.02	1.61
POWERLINE	0.09	0.97	0.91	0.21	2.18

*Most of the proposed disturbance to borrow area A1 would be inundated and, therefore, is not additive with other disturbances.

Of note with regard to loss of mixed conifer vegetation, is the associated loss of timber resources. As indicated in Section 3.7, tree density was estimated at about 450 stems per acre. However, because of the small acreage (20± acres) and marginal sawtimber involved, the effect on timber resources is less marked. These resources may be salvaged prior to construction. Salvage would consist of some potential sawtimber and polestock, but primarily firewood. Owing to the mixed heights and species involved (for which data were not collected), an accurate estimate of sawtimber, poles, or cordwood cannot be made.

4.7.2.3 Alternative C - Smaller Reservoir Expansion

Alternative C would involve a reduced increase in capacity over that of Alternative B. A total of approximately 29.5 acres of vegetation would be affected as opposed to the 51.4 acres under Alternative B. Because of relatively equal distribution around the current reservoir, the proportionate decrease would be nearly equal among the four affected vegetation types. Although the amount of overall disturbance would be less with Alternative C, the proportion of Borrow Area A-1 that could be inundated would be reduced from three-quarters to about one-half. Therefore, the net effect of Alternative C would only be a reduction of approximately 20 acres of vegetation disturbance.

4.7.2.4 Borrow Area Options

Given the differences regarding inundation of Borrow Area A-1 depending on reservoir alternative, the potential disturbance to remaining vegetation types of borrow areas would become additive depending on need for rip-rap or other fill material. Therefore, as much as 12.3 acres of wetlands could be disturbed in the borrow areas. In a similar manner, 32.9 acres of upland meadow, 30.2 acres of mixed conifer, and 6.1 acres of previously disturbed ground could be disturbed as need for particular fill material is realized.

A commitment has been made by the project Proponent to retopsoil and reseed with native grasses all disturbed borrow areas. Because no detail has been provided to allow an evaluation of the feasibility of this commitment and potential for success, two possible outcomes may result. First, the reclamation attempt may be successful and in such a situation, long-term effects of borrow removal would be limited to loss of existing timber resources. Conversely, the reclamation attempt could fail resulting in long-term loss of vegetation communities disturbed. In this latter circumstance, impacts would go beyond the long-term loss of vegetation resources and include degraded visual resources.

4.7.2.5 Campground Site Relocation Options

Campground Relocation Site 1 would affect 6.9 acres of vegetation about equally split between upland meadow and mixed conifer. Campground Relocation Site 2 would affect 1.6 fewer acres than Site 1, but the same two communities would be affected, upland meadow and mixed conifer. However, Site 2 would affect more mixed conifer vegetation than the proposed site, 4.8 acres versus 3.6 acres.

4.7.2.6 Road Corridor Options

As indicated, three road corridor options have been identified for this project, and road construction would result in the disturbance of various acreages of vegetation communities, depending upon the road corridor option. As indicated in Table 4-4 above, Road Corridor Option 1 affects the least acreage (including wetlands), but would impact the most mixed conifer. Option 2 would affect the most acreage including 0.37 acres of wetland and 0.82 acres of mixed conifer. Road Corridor Option 3 would affect median acreage, the least mixed conifer (0.71 acres), and the most wetland (0.48 acres).

4.7.3 Cumulative Impacts

Under all three alternatives, (A, B, and C) more trampling by recreationists and displacement of vegetation would occur with increased human use of the area.

4.7.4 Mitigation and Enhancements Summary

In addition to the wetlands mitigation discussed in Section 4.5.4, under Alternatives B and C, disturbed areas would be regraded and reseeded with a native grass mixture.

4.7.5 Unavoidable Adverse Impacts

Under Alternatives B and C, existing vegetation communities affected by inundation or facility construction would be permanently lost. Reclamation of disturbed borrow areas could return these areas to aesthetically pleasing and functioning vegetation communities.

4.7.6 Irreversible and Irretrievable Commitment of Resources

Acreage which would be inundated by the proposed expansion would be irreversibly committed to water storage. As a result, this acreage would no longer be available to support wetlands, upland meadows, or coniferous forest. Likewise, new roads that are developed would commit resources for the long-term unless reclaimed. Furthermore, timber resources currently existing proximal to the reservoir would also be irretrievable once harvested.

4.8 WILDLIFE/FISHERIES

4.8.1 Introduction

This section addresses potential direct and indirect impacts that would be associated with the alternatives addressed by this EIS. These impacts are discussed below for all wildlife, with particular emphasis placed on potential effects to wildlife species of concern including:

- Big game
- Raptors
- Trout
- and Federal Threatened, Endangered, or Candidate species

4.8.2 Direct and Indirect Impacts

4.8.2.1 Alternative A - No Action

Under the Alternative A, the project area would essentially remain in its existing state. As a result, future habitat conditions and wildlife use of the project area would be similar to those currently existing at the reservoir site, assuming there are no major alterations in current land use activities. Stream habitat in the Puppy Dog Lake channel would continue to be degraded by high spring flows, and no long-term conservation pool would be maintained for fisheries in the reservoir itself.

4.8.2.2 Impacts Common to All Action Alternatives

The potential impacts of Alternatives B or C on wildlife populations can be classified as short-term and long-term. Short-term impacts arise from habitat disturbance as well as from construction activities associated with reservoir expansion. These impacts cease upon completion of reservoir expansion and successful reclamation of non-inundated disturbance areas. Long-term impacts consist of permanent habitat changes associated with disturbed and inundated areas irrespective of reclamation success. The major impact categories which would potentially affect wildlife populations are direct habitat removal or alteration and increased human presence and noise.

<u>Direct Habitat Loss or Alteration</u> - The greatest impact to all wildlife would be the temporary or permanent loss or alteration of habitat. Temporary loss or alteration of habitats would be caused by construction of enlarged dam areas; transportation corridors; a new campground site; inundation by the expanded reservoir; and excavation at borrow sites. Habitat loss or alteration would result in minor losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and displacement of more mobile species to adjacent undisturbed habitats until construction and reclamation is completed. Existing information regarding wildlife population numbers for these animal groups within the project area is not available, and the magnitude of wildlife losses and displacement is impossible to predict. However, the total extent of habitat loss can be addressed.

Long-term or permanent loss or alteration of habitat would result if reclamation efforts cannot return disturbed areas to conditions similar to those that were present prior to mining. Where reclaimed and unreclaimed habitats support less productive and less diverse vegetation communities than those present prior to project development, the long-term impacts would be negative with regard to re-establishment of wildlife populations to existing condition levels. Areas inundated by the proposed reservoir expansion would result in permanent losses in terrestrial and small stream habitats around the perimeter of the existing reservoir and a gain aquatic lake habitat. Transportation corridor, borrow area, and new campground disturbances would be primarily short-term and be mitigated by reclamation following construction completion. However, based on past reclamation efforts on existing borrow areas, newly reclaimed borrow areas are not expected to return to existing levels of vegetation diversity and productivity.

Acreage of disturbed habitat are listed for each development alternative in Table 4-4, Potential Disturbed Acreage by Vegetation Type. Differences in the extent of disturbance and habitats affected relate principally to differences in reservoir expansion size and in the location of transportation corridors, borrow sources, and the relocated campground site.

No loss of critical or important habitat for any Federally listed Threatened, Endangered, or Proposed species would occur with Alternatives B or C. The endangered bald eagle and American peregrine falcon occur in the region, but no nesting or important foraging habitat of these species would be affected with reservoir expansion (see Biological Assessment, Appendix J) . Four endangered fish species (Colorado squawfish, humpback chub, bonytail chub, and razorback sucker) occur downstream of the project area in the Colorado River and its mainstem tributaries. Populations and habitats of these species would not be directly affected by expansion of the Fish Creek Reservoir, but resultant modifications in the timing and quantity of water releases from Fish Creek Reservoir could result in relatively minor changes in downstream flow regimes which could affect these species (see Biological Assessment, Appendix J).

Direct habitat loss has the potential to affect four Federal Candidate (C2) species (wolverine, lynx, northern goshawk, and boreal toad) and one state listed Threatened species (wood frog). It also possible that additional habitat could be created for another Federal Candidate (C2) species, Colorado River cutthroat. Other species of concern potentially affected by habitat loss include big game (elk and mule deer), raptors, and brook trout.

Wolverine and lynx prefer high mountain areas and suitable habitats occur in the vicinity of the project area. Scattered unconfirmed sighting of wolverine have been made near the project area, but no observations of lynx have been recorded. Both species are wide-ranging and may possibly occur in the general area. However, the reservoir site would represent a very small proportion of their range and proposed disturbance areas do not represent preferred habitats for these species. Therefore, reservoir expansion is not expected to result in any negative impacts to wolverine or lynx populations.

Northern goshawks nest in mature and old-growth coniferous forest. Old-growth forest habitats with a relatively open understory are preferred. Nesting birds are relatively intolerant of human disturbance. Recreational activities and the current lack of old-growth habitats in the vicinity of Fish Creek Reservoir reduce the potential for any goshawk nesting use of the project area. No nests or evidence of goshawk nesting activity (pluck sites, whitewash, or pellets) were observed in proposed disturbance areas. A single observation of a northern goshawk during the 1992 field surveys indicates that goshawks may occasionally use the project area for hunting. The reservoir expansion

may result in a slight reduction in available hunting habitat for northern goshawk, but no loss of suitable nesting habitat would occur.

As indicated in Section 3.8, Wildlife, suitable boreal toad breeding habitat, consisting of shallow water wetland areas, exist within the project area, although no boreal toads were observed during the 1992 field surveys. Field review of proposed disturbance areas did not identify any suitable breeding habitat within the borrow, transportation corridor, or campground sites. However, the reservoir expansion would inundate potential boreal frog breeding habitat adjacent to the east end of the reservoir. Suitable habitat within the inundation area consists of small, shallow pools associated with wetland habitats along Granite Creek and other small springs feeding the reservoir. Only a small portion of these wetlands contains pool areas suitable for breeding. The portion of Middle Fork Fish Creek to be inundated has too steep a gradient and does not support suitable boreal toad breeding habitat.

Wood frogs prefer shallow, natural ponds, supporting extensive growth of sedges in shallow water areas and lacking a permanent inlet or outlet, for breeding. Shallow ponds in upland meadow habitat in the vicinity of the reservoir represent suitable breeding habitat for these species. No wood frogs were located during field surveys, and no shallow pools in upland meadow areas would be disturbed by reservoir expansion activities. Adverse impacts to wood frog populations are not expected with reservoir expansion.

The Colorado River cutthroat currently does not occur within the waters of the project area, but suitable habitat is present. As indicated in Section 3.8, Wildlife, dam and spillway construction associated with reservoir expansion would isolate the reservoir and its feeder streams from fish movement below the reservoir. As a consequence, the Colorado Division of Wildlife (CDOW) could consider restoring Colorado River cutthroat into Fish Creek Reservoir and its upstream drainages sometime in the future. However, the CDOW considers Fish Creek Reservoir to be a low priority introduction site because of relatively easy public access, high public recreational use of the area, and operation of the reservoir as a municipal water supply (Sealing, 1992).

The project area occurs within elk and mule deer summer range, and project development would result in a slight reduction of summer range in the region. Permanent habitat loss would occur in the areas inundated by the expanded reservoir. Additionally, new roads would account for a minor amount of relatively permanent habitat loss. It is also projected that vegetation in the borrow areas would not be returned to pre-disturbance diversity and productivity levels. Therefore, lost carrying capacity or displacement from these areas would continue after construction.

These habitat losses and reductions in habitat quality, however, are not expected to have any measurable effect on regional elk and mule deer populations because summer habitats are not considered limiting for these species, and existing recreational activities in the vicinity of the reservoir have already limited the suitability of existing habitats.

As indicated in Section 3.8, Wildlife, a variety of forest birds of prey occur and nest in the region. Nesting habitat for most species is limited in the project area by the general lack of suitable tree or cliff nest sites. In addition, no old-growth forested habitat, preferred for nesting by species such as pygmy owl and boreal owl, would be disturbed by reservoir expansion. As a result, project development is expected to have little effect on regional populations of nesting raptor species.

Fisheries habitat would be affected by the reservoir expansion. Reservoir expansion would create additional high mountain lake habitat but would reduce the amount of available stream habitat in Middle Fork Fish Creek and Granite Creek above the reservoir. The greatest amount of inundation would occur along Granite Creek since its gradient is less steep than Middle Fork Fish Creek. Because of the steepness of Middle Fork Fish Creek in most of the inundation area there are few pools, and trout habitat was rated as relatively poor. In contrast, the portion of Granite Creek which would be inundated exhibits characteristics of a mountain meadow stream with numerous deep pools. This section of the stream provides high quality trout habitat and supports numerous, but small, brook trout.

<u>Human Presence and Noise</u> - Increased levels of human activity and noise associated with construction activities related to reservoir expansion has the potential to displace local wildlife populations beyond the actual areas of habitat disturbance. The most common response of wildlife to noise and human presence is avoidance or accommodation. Reaction of animals to noise varies depending on the intensity of the noise source and whether it is continuous or intermittent. Transient loud noises generally provoke alarm responses, while many animals apparently learn to ignore more constant, lower level noise sources that are not associated with negative experiences such as being chased or hunted. Avoidance would result in displacement of animals from an area larger than the actual disturbance area.

The total extent of habitat lost as a result of wildlife avoidance response is impossible to predict since the severity of this response varies from species to species and can even vary between different individuals of the same species. Also, after initial avoidance of human activity and noise producing areas, certain wildlife species may acclimate to the activity and begin to reinvade areas formerly avoided. Since the project area already receives considerable human recreational activity, additional wildlife avoidance in response to construction activities is expected to occur only in the immediate area of construction activity. This avoidance should be relatively short-term and cease shortly after construction is completed.

In addition to avoidance response, increased human presence intensifies the potential for wildlife/human interactions ranging from harassment of wildlife to poaching and legal harvest. Possible impacts from poaching can be alleviated by prohibiting the possession of firearms by the construction crew within the project area. Posting state hunting and fishing regulations at a conspicuous place on the job site and making violation of regulations grounds for dismissal would also reduce the chance of game and fishery violations.

Increased human presence and related increases in traffic levels on project access roads also increases the potential for wildlife/vehicle collisions. Construction related to reservoir expansion would require a 30-person crew for two seasons from late May to October. It is projected that, during the two construction periods, there would be an average increase in round-trip traffic of 15 vehicles per day on project access roads. Peak traffic levels would be 30 vehicles per day. If a construction camp is established at the project site, traffic levels would average 7 vehicles per day with a peak of 15 vehicles per day. The potential for wildlife/vehicle collisions is typically highest in the early morning and evening hours and where roads traverse ranges or areas where mule deer or elk congregate. The potential for an increase in wildlife/vehicle collisions is unknown but is expected to be low for two reasons. First, construction would not be initiated until after mule deer and elk have begun to disperse from winter concentration areas at the lower elevations. Second, vehicle speeds along most of the access route would be relatively slow due to the steepness of the route and the rough road surface.

4.8.2.3 Alternative B - Proposed Reservoir Expansion

Alternative B disturbs the greatest amount of upland, wetland, and stream habitats. The expanded reservoir area would permanently inundate 36.4 acres of terrestrial habitat and 15 acres of wetland habitat for a total loss of 51.4 acres. Due to the relatively small losses of habitat and heavy recreational use in the vicinity of the reservoir, the reduction in upland and wetland habitats is not expected to have any measurable effect on local terrestrial wildlife populations. Disturbance to other terrestrial habitats by construction activities would be relatively short-term, and effects on local wildlife populations from these disturbances would also be negligible. With the Borrow Source A-1 option approximately 45 acres would be disturbed by construction activities related to the dam enlargement, new campground, and roads. However, 28 acres of Borrow Area A-1 would be inundated by the expanded reservoir so construction activities would account for only about 18 acres of additional total disturbance.

Within wetland areas to be disturbed, approximately 260 feet of Middle Fork Fish Creek and 1,350 feet of Granite Creek would be inundated by reservoir expansion Alternative B. Loss of stream habitat above the reservoir would be mitigated to some extent by agreements which would improve fisheries habitat and maintain minimum in-stream flow in lower Fish Creek. The CDOW may be interested in improving recreational fishing in the reservoir by stocking catchable sized fish as well as fry (Sealing, 1992). The expanded reservoir would have sufficient capacity to maintain a conservation pool at maximum drawdown. A conservation pool would also enhance the viability of the fishery and improve recreational fishing opportunities.

4.8.2.4 Alternative C - Smaller Reservoir Expansion

This alternative involves a smaller expansion than that proposed under Alternative B. With Alternative C, reservoir expansion would inundate an additional 29.5 acres of upland and wetland habitats, as compared to 51.4 acres for Alternative B. As with Alternative B, the majority of habitat loss would involve wetland, upland meadow, and mixed conifer habitats (see Section 4.7, Vegetation). With the Borrow Source A-1 option, approximately 34 acres would be disturbed by construction activities related to the dam enlargement, new campground, and roads. However, approximately 13 acres of Borrow Area A-1 would be inundated by the expanded reservoir so construction activities would account for only about 21 acres of additional total disturbance.

Within wetland areas to be disturbed, approximately 130 feet of Middle Fork Fish Creek and 390 feet of Granite Creek would be inundated by Alternative C. Mitigation agreements which would improve fisheries habitat and maintain minimum in-stream flow in lower Fish Creek under Alternative B would not apply to Alternative C. In addition, with smaller reservoir expansion, there would not be sufficient reservoir capacity to maintain a conservation pool during maximum drawdown periods.

4.8.2.5 Borrow Area Options

Three borrow area options are being considered as a part of this project. As indicated above surface disturbance associated with Borrow Area A-1 would be dependent on which reservoir expansion alternative is selected. The potential disturbance to terrestrial habitats by use of optional Borrow Areas A-2 and B would become additive depending on need for rip-rap or additional fill material for either reservoir alternative. Therefore, as much as an additional 26.4 acres could be disturbed through use of Borrow Areas A2 and B. The majority of this disturbance (26.2 acres) would occur

in upland meadow and mixed conifer habitats (see Section 4.7, Vegetation). Neither additional borrow area (A2 or B) would affect any additional wetland habitat.

The Proponents have committed to replace topsoil and reseed with native grasses all disturbed borrow areas. However, no details have been provided to allow an evaluation of the feasibility of this commitment and potential for success. Therefore, it is assumed that the majority of the productivity of the endemic soils overlying the borrow areas (excluding rock outcrop areas) would be lost, and vegetation diversity and productivity would not be returned to pre-existing conditions. As a result there would be a long-term loss in habitat quality in the borrow source areas.

4.8.2.6 Campground Relocation Site Options

Campground Relocation Site 2 would affect 1.6 fewer acres of upland habitat than Campground Relocation Site 1. Upland meadow and mixed conifer habitats would be the only habitats affected by either campground option. However, Site 2 would affect more mixed conifer habitat (4.8 acres versus 3.6) and less upland meadow habitat (0.5 acres versus 3.3) than Site 1.

4.8.2.7 Road Corridor Options

As indicated, three road corridor options have been identified for this project. Each road construction option would result in relatively minor differences in habitat disturbance. Road Corridor Option 1 affects the least acreage (1.49 acres), including wetlands, but would impact the most mixed conifer habitat. Road Corridor Option 2 would affect the most acreage (1.69 acres), including 0.37 and 0.82 acres of wetland and mixed conifer habitats, respectively. Road Corridor Option 3 would affect slightly less habitat (1.61 acres) than Option 1. It would also affect the least amount mixed conifer habitat (0.71 acre) and the most wetland habitat (0.48 acre).

4.8.3 Cumulative Impacts

Under all three alternatives (A, B, and C), greater use of the area would result in further displacement of wildlife.

4.8.4 Mitigation and Enhancements Summary

Under all alternatives, (A, B and C), Fish Creek Reservoir would be restocked.

4.8.5 Unavoidable Adverse Impacts

Existing terrestrial and stream habitats affected by inundation or by campground and road construction would be permanently lost as a result of the implementation of Alternatives B or C. Mitigation in the form of habitat improvement and maintenance of minimum stream flow in Fish Creek would somewhat mitigate stream habitat losses associated with Middle Fork Fish Creek and Granite Creek. Reclamation of disturbed borrow areas would revegetate these disturbances, but it is unlikely that reclaimed borrow areas would support vegetation as productive and diverse as that existing prior to disturbance.

4.8.6 Irreversible and Irretrievable Commitment of Resources

Terrestrial and stream habitats inundated by the proposed expansion would be irreversibly committed to water storage and converted to lake habitat. New roads that would be developed would also commit habitat resources for the long-term unless reclaimed.

4.9 RECREATION

4.9.1 Introduction

Fish Creek Reservoir, although accessible by car, is a fairly remote recreation area with a limited amount of developed facilities. For these reasons, the reservoir provides a rather pristine and uncrowded recreation setting, even when the campground is full. Although use can become concentrated on the weekends, the campground's low capacity and poor access protects the nature of the recreational setting. Visitors have come to appreciate the solitude afforded to them at the reservoir, making Fish Creek Reservoir a valued recreational resource.

The scope of this discussion consists of potential impacts to developed and dispersed recreational resources defined in Section 3.9, Recreation. The primary study area refers to Fish Creek Reservoir and its immediate surroundings, while the secondary study area refers to other resources in the Routt National Forest that could be indirectly affected by the proposed reservoir expansion. Study area boundaries and the location of recreational resources are shown in figures presented in Section 3.9.

4.9.2 Direct and Indirect Impacts

4.9.2.1 Alternative A - No Action

Under Alternative A, the existing campground would remain and continue to degrade.

4.9.2.2 Alternative B - Proposed Reservoir Expansion

Short Term Impacts - The proposed expansion of Fish Creek Reservoir under Alternative B, would affect primarily the summer-use season. The expanded shoreline would inundate Granite Campground (4 campsites and picnic tables), a parking lot, and a user-created trail that circles the reservoir. Because these facilities would be replaced as part of project mitigation, the loss of developed and dispersed recreation resources at Fish Creek Reservoir would be temporary and would coincide with the proposed 2-year construction plan. Thus, as a result of the construction phase of the project, recreationists who visit Fish Creek Reservoir for dispersed and developed recreation would be temporarily displaced.

Granite Campground currently records approximately 1,000 Recreation Visitor Days (RVD's) each summer (USDA, 1992). The primary study area is also commonly used by anglers, mountain bikers, hikers, and hunters. As a result of the temporary displacement of these visitors, recreational resources in the secondary study area such as campgrounds, trails, lakes, and parking facilities would be indirectly impacted by the expansion of Fish Creek Reservoir. The absorption of Fish Creek Reservoir visitors by facilities in the secondary study area would result in increased pressure on the recreational resources at these facilities, and could potentially cause a decrease in the quality of some recreational experiences. Because many of the developed resources in the secondary study area are already overused (Schmitzer R., 1992), the addition of visitors from Fish Creek Reservoir could potentially augment existing problems. Summit Lake and Long Lake, which contain similar

resources and are in close proximity to Fish Creek Reservoir, should absorb the majority of displaced visitors unable to recreate in the primary study area. Good signage and public awareness could aid in dispersing visitors.

Other short term impacts associated with Alternative B include disturbances to the area by construction-related activities. The visual quality of the primary study area would be affected by the draining of the reservoir and by the presence of construction vehicles, a construction camp and borrow pits (See Section 4.11, Visual Resources). Consequently, the quality of the recreation experience for mountain bikers, hikers and sightseers travelling past the reservoir along FDR 310 would be affected. In the secondary study area, the presence of construction vehicles going to and from the reservoir along FDR 60 and 310 would also affect recreation experiences.

Long Term Impacts - Over the long-term, Alternative B would affect future recreation patterns in the primary study area. Since the proposed expansion includes, as part of project mitigation, plans to replace the existing campground with an upgraded and larger campground, recreational use of Fish Creek Reservoir should increase. Plans for the new campground include eight campsites (with space for eight future sights), additional parking, and an improved boat ramp (See Section 4.9.5, Mitigation and Enhancements Summary). With power at the site, a potable water supply would be installed. With potable water available, the Forest Service would make Granite Campground a "fee area" which may change the recreation experience for those who have traditionally used the area free of charge. The new site would also be accessible to the disabled. These modifications would increase the capacity of the campground and would likely affect the user population. By increasing the capacity and accessibility of Granite Campground, pressure on over-crowded facilities in the secondary study area would be reduced by better dispersing visitors throughout the Buffalo Pass area. However, a shift to increased usage on Fish Creek Reservoir would likely result in minor impacts to the water quality of the reservoir and to the relatively pristine nature of the area, both of which are valuable characteristics of the reservoir.

4.9.2.3 Alternative C - Smaller Reservoir Expansion

If Alternative C is chosen, recreational facilities discussed above would still be inundated and would need to be replaced. Subsequently, the impacts to recreational resources associated with Alternative C, Smaller Reservoir Expansion would be identical to those associated with Alternative B, Proposed Reservoir Expansion.

4.9.3 Connected Actions

Future increases in recreational use of Fish Creek Reservoir would be connected to actions other than the expansion of the reservoir. Increases in visitor use of Fish Creek Reservoir should be expected as a result of summer marketing measures. The present marketing strategies of the City of Steamboat Springs and the Chamber Resort Association, which aim to increase summer tourism in Steamboat Springs, could create additional demand for developed and dispersed recreation in the Routt National Forest. In order to accommodate this future demand and relieve pressures on existing facilities in the Buffalo Pass area, the Forest Service is developing the Buffalo Pass Capital Investment Project. The project is a means of further dispersing visitors throughout the area and reducing the environmental impacts, associated with the heavy use of the Buffalo Pass area. The project plans to expand the supply of developed facilities in the Buffalo Pass area and includes a proposal to enlarge Granite Campground in conjunction with the Fish Creek Reservoir expansion. The project will also improve access to the area by upgrading Buffalo Pass Road. While the Buffalo Pass Capital Improvement Project is intended to accommodate the increased use trend in the Buffalo

Pass area by dispersing recreationists, it could result in increased recreational use of the Fish Creek Reservoir area. Thus, although future increases in recreational use of Fish Creek Reservoir would result from the mitigation proposed for the reservoir expansion, these increases could occur to some extent without the project due to marketing measures which increase tourism, and to the Buffalo Pass Capital Investment Project, which is intended to disperse visitors within the heavily used Buffalo Pass area.

4.9.4 Cumulative Impacts

Use levels in the Buffalo Pass area should steadily increase because accessible recreation opportunities are in demand and are being targeted by summer marketing measures in Steamboat Springs (See Section 3.4, Socioeconomics). Consequently, if Alternative B, Proposed Reservoir Expansion, or Alternative C, Smaller Reservoir Expansion, is chosen, their short term impacts to the secondary study area and long term impacts to the primary study area could be increased by additional tourism to the area.

4.9.5 Mitigation and Enhancements Summary

Due to the inundation of Granite Campground, under Alternatives B or C, the Proponent would rebuild the campground above the expanded shoreline. Proposed mitigation for Alternatives B and C is the same and involves the construction of a new campground at one of two possible relocation sites. New facilities would include a two-way gravel entrance road, four vehicle access camping sites, four walk-in tent sites, one composting toilet, a concrete boat ramp (with a length to accommodate water level decrease of the reservoir during the heavy use recreation season), two picnic sites, 15 vehicle gravel parking, potable water, and information boards. Both of the roads and the parking facility would be gravel to reduce possible run-off of petroleum products into the reservoir. A drinking water system would also be installed, and would allow the Forest Service to charge a fee for use of the campground. The fees generated would be used to maintain the campground facilities. The shoreline trail which currently circles the reservoir would not be rebuilt (the Forest Service has decided to let the trail be formed by the users again).

4.9.6 Unavoidable Adverse Impacts

If Alternative B or Alternative C is chosen, the unique character of Fish Creek Reservoir would be altered permanently. As described briefly in this section and in more detail in Section 3.9, Recreation, Fish Creek Reservoir is a fairly remote recreation area with a limited amount of developed facilities, and thus provides a rather tranquil and pristine recreation setting. An enlargement of the reservoir and the subsequent expansion of the developed facilities at the reservoir would attract more visitors to the area and would, as a result, alter the pristine character of the recreation setting. As noted above, this could happen to some extent anyway due to Forest Service actions and summer marketing. The upgraded recreation facilities, however, could lend to the enjoyment of the area.

4.10 TRANSPORTATION

4.10.1 Introduction

There are two transportation routes to Fish Creek Reservoir. As identified and discussed in Section 3.10, the West Route provides access to the reservoir from the City of Steamboat Springs along FDR 60 and FDR 310, while the East Route provides access from North Park in Jackson County.

Because all mobilization of construction related equipment would occur on the West Route, there would be no foreseeable impacts to the East Route. Potential impacts to the West Route which could occur as a result of the Proposed Action and project alternatives are discussed below.

4.10.2 Direct and Indirect Impacts

4.10.2.1 Alternative A - No Action

Under Alternative A, the existing service roads accessing the main and saddle dams would continue to erode.

4.10.2.2 Alternative B - Proposed Reservoir Expansion

The impacts associated with Alternative B would be primarily direct, short term impacts. Assuming that appropriate mitigation is performed, the west transportation corridor to Fish Creek Reservoir would be affected during the construction period only. Thus, impacts to transportation routes would be temporary and would coincide with the proposed construction activities of the project.

Safety Concerns - Mobilization of construction related equipment to and from the project site would occur once in July and once in October in year one and year two of construction respectively. As previously mentioned, mobilization would be along the West Route. Approximately 15-30 vehicles per day (carrying heavy equipment), would be using the West Route during the mobilization phases of the project. The ADT on the west side of FDR 60 would increase from 83 to approximately 113 during the weekdays, with peak weekdays reaching as high as 143. During the weekends, the ADT would likely exceed 200.

Because of these increases in traffic, the probability of an accident occurring along the West Route (during mobilization) would increase. Most of the increased traffic during mobilization would be heavy equipment. Because FDR 60 and FDR 310 are commonly used by mountain bikers, the safety of recreational bikers would be a concern, as the probability of an automobile/bicycle accident would also increase during mobilization.

Construction activities would occur between July and October during both years of construction. During construction, approximately 7-15 supply vehicles per day carrying such things as fuel, concrete, and workers would also be using the West Route and would thus increase the traffic and the probability of an accident along this transportation corridor. During the construction period, the ADT along the west side of FDR 60 would increase from 83 to approximately 97 during the week, with peak weekdays reaching 113. On the weekends, the ADT would increase to approximately 187. Due to these increases in traffic and due to the width of the roads (approximately 15 to 20 feet wide), the probability of a traffic accident occurring along the West Route during the construction period of the proposed project would increase. Again, the safety of recreational bikers using FDR 60 and FDR 310 would also be affected during the construction period.

As discussed in Section 3.10, access to the West Route (FDR 60) would be through the City of Steamboat Springs. Because of this, increases in traffic and in the probability of an accident would also occur along the designated city access routes identified in Section 3.10.

A final safety impact associated with the proposed project would be an increased chance of a hazardous spill occurring along the West Route. During the construction phase, fuel trucks would

be travelling along the West Route. Approximately 2.7 miles of roads along the West Route are in close proximity to creeks or streams (as defined in Section 3.10). At locations where the West Route is in close proximity to water resources, there would be a high probability that a spill could reach a creek or stream before cleanup could be completed.

Road Conditions - Along the West Route, from Dry Lake Campground to Fish Creek Reservoir, there are several sections of roads which have little or no base material. These areas, when wet, can be soft and easily damaged. If a decision to expand Fish Creek Reservoir is made, the City would remove snow from the West Route in the spring and would then transport the equipment required for the proposed expansion to Fish Creek Reservoir. During the mobilization of this heavy equipment, the road surface would likely be wet, and in soft areas where there is little or no base material, damage to the road would likely occur. In addition, according to Section 3.10, there are several culverts along the West Route which have less than one foot of cover. During the mobilization periods, there would be a high probability that these culverts would be damaged.

During the construction period of the Proposed Action supply vehicles would be using the West Route daily. By this time, the roads should dry out and should be more conducive to handling an increased load. Furthermore, the weight and size of the supply vehicles would be less than that of the heavy equipment being moved initially. Thus, impacts which would occur to the roads during the construction phase could be of a lesser degree than those impacts which would occur during the mobilization of heavy equipment. However, because of rainfall, the roads would still be wet at times and would continue to be susceptible to damage from the transport of equipment and supplies. In addition, culverts with less than one foot of cover would also be prone to damage.

New Road Construction - Under Alternative B, a portion of FDR 310.2 would be inundated. To replace this portion of the road, the City has proposed three road corridor options as shown in Figure 2-5. The preferred road alternative would be constructed using conventional equipment and would be covered with gravel. There would be disturbances to wetlands, however, associated with all three of the road alternatives. These disturbances would be as follows:

- Road Corridor Option 1 would be constructed through the trees approximately 100 feet from an open meadow. It would disturb approximately 0.69 acres of land, 0.04 acres of which would be wetlands.

- Road Corridor Option 2 would be constructed through the middle of an open meadow. It would disturb approximately 0.89 acres of land, 0.37 acres of which would be wetlands.

- Road Corridor Option 3 would be constructed along the expanded shoreline adjacent to an open meadow. It would disturb approximately 0.80 acres of land, 0.48 acres of which would be wetlands.

A detailed discussion of impacts to wetlands is presented in Section 4.5, Wetlands.

4.10.2.3 Alternative C - Smaller Reservoir Expansion

The impacts associated with Alternative C would be generally the same as those associated with Alternative B. It is possible that less equipment, and thus less vehicles, would be required for a smaller reservoir expansion. It is assumed, however, that the majority of the increases in traffic associated with Alternative B would also occur under Alternative C. Thus, the impacts to the

condition of the West Route and the increases in the probability of an accident that are associated with Alternative B, would also occur if Alternative C is implemented. Furthermore, a smaller reservoir expansion would still inundate a portion of FDR 310.2. Road alternatives to replace this portion of FDR 310.2 would be identical to those mentioned above.

4.10.3 Cumulative Impacts

Cumulative impacts to FDR 60 and FDR 310 could occur as a result of the incremental effects of:

- Normal traffic levels
- Increases in traffic due to increases in tourism
- The addition of heavy equipment and supply vehicles using the roads during the mobilization and construction periods of the proposed reservoir expansion

It is anticipated, however, that the majority of transportation-related impacts associated with an expansion of Fish Creek Reservoir would occur as a direct result of the project itself. To a small degree, the aforementioned impacts to FDR 60 and FDR 310 could be augmented by the cumulative effects of tourist traffic combined with construction-related traffic, but potential increases due to tourist traffic should be negligible.

4.10.4 Mitigation and Enhancements Summary

Due to the impacts to transportation safety and to road conditions that would occur as a result of Alternatives B or C, various mitigation measures have been suggested. In order to minimize the probability of an accident due to increased traffic, mobilization of heavy equipment, and transportation of supply vehicles, the following measures should be implemented:

- During mobilization of heavy equipment to the site, the West Route from Dry Lake Campground to Fish Creek Reservoir should be closed to public traffic
- Supply trucks should only be allowed to travel the West Route on weekdays during daylight hours
- The City should post signs indicating that supply trucks may be encountered along the West Route on weekdays during daylight hours
- During mobilization of heavy equipment through town, pilot cars should be used
- A schedule should be developed to minimize supply truck travel through town during peak morning hours and late afternoon hours when people are travelling to and from work or school
- Supply trucks and heavy equipment should use City Route 1 (as defined in Section 3.10) because this route travels through less dense neighborhoods and traffic loads are normally lighter
- Car pooling among those working at Fish Creek Reservoir should be encouraged if a construction camp is not utilized.

- An approved emergency hazardous waste spill response plan (describing procedures to be implemented in case of a fuel or hazardous waste spill) should be submitted by the Forest Service before any fuel or other hazardous material is transported over the West Route

In addition, to minimize the impacts to the road conditions along the West Route, the Proponent should submit and implement a road maintenance plan which ensures that the surface of the roads remain in the same condition as described in the Road Condition Survey (RCS) conducted in October 1992 (ACZ, 1992e). This could include the replacement of damaged culverts and/or drainage ditches, as well as the addition of suitable base material in areas significantly damaged by heavy equipment. Road repair and maintenance would be approved and inspected by the Forest Service.

Finally, it is suggested that Road Corridor Option 1 (as identified above) be used to replace the inundated portion of FDR 310.2. Road Corridor Option 1 would disturb the least amount of land and the least amount of wetlands, and would be less visible from the reservoir area than the other two alternatives. Precautions should also be taken so that any material imported for the road surfacing does not contain noxious weeds. Additionally, all road sections that will no longer be required after construction is completed should be properly reclaimed according to Forest Service criteria.

4.10.5 Unavoidable Adverse Impacts

If Fish Creek Reservoir is expanded, under either Alternative B or Alternative C, there would be no long-term unavoidable adverse impacts to either the West Route or the East Route.

4.11 VISUAL RESOURCES

4.11.1 Introduction

The visual impact analysis is based on the premise that visitors to the National Forest prefer to see the forest in a condition as close as possible to its natural state, and thus facility development, such as the Proposed Action should be as compatible as possible to the natural form, line, color, and texture, consistent with other resource requirements of the forest. In the case of Fish Creek Reservoir, municipal water supply is considered an important resource use of the area and thus a certain degree of visual change is considered acceptable by the Forest Service to allow development of the water supply resource.

The Forest Service, therefore, has assigned a "modification" visual quality objective (VQO) for the Fish Creek Reservoir and adjacent lands (Management Area 10E), except for the FDR 310 corridor (Management Area 2B), which has been assigned a "partial retention" visual quality objective (see Figure 1-2). Compatibility with visual quality objectives is determined based on the following considerations:

- Will the project be highly visible?
- Will the project be consistent with the existing scenic quality?
- Will the project be designed to blend into the setting so changes are not highly noticeable?

Significant impacts would be actions that do not meet the Forest Service's visual quality objectives by creating an unacceptable level of contrast with the adjacent natural landscape as seen from sensitive areas, regardless of mitigation and reclamation measures. In some cases, proposed actions will create beneficial visual quality impacts, which are also noted.

4.11.2 Direct and Indirect Impacts

4.11.2.1 Alternative A - No Action

Under Alternative A, the existing visual problems at the reservoir would remain the same. These include the former borrow areas that have not been adequately reclaimed, the existing maintenance shed, and the access road on the north terminus of the dam. These areas currently do not meet the "modification" VQO, as discussed in Section 3.11.

In addition, low in-stream flows in the portion of Fish Creek downstream of the water filtration plant would continue to impair the creek's visual quality. During the fall season, flows in this portion of the creek can be reduced to almost zero flow. Extremely low flows reduce the visual interest of the creek, as pools and riffles dry up, whitewater disappears, and the river bottom becomes exposed. The low flows generally occur between late July and early November. Steamboat Springs has been experiencing a gradually increasing number of visitors during this period, due to the City's summer marketing effort (see Section 3.4). Since Fish Creek flows through the Sheraton Golf Course, the Anglers Drive residential neighborhood, and the Fish Creek Trailer Park and crosses the recently completed Yampa River Trail, it is of relatively high sensitivity.

An indirect impact of Alternative A would be the effects of water shortages that could occur without the expanded reservoir capacity. Water shortages could result in watering restrictions, which would adversely affect the residential and commercial landscapes and ornamental plantings in Steamboat Springs. The City depends on landscaping to mitigate the adverse visual effects of various types of development. It is also possible, however, that within the next 20 years more drought resistant plants can be gradually phased into the City's planting standards.

4.11.2.2 Alternative B - Proposed Reservoir Expansion

<u>Short Term Direct Impacts</u> - Construction activities associated with Alternative B would result in short-term visual impacts for two consecutive recreation seasons. Since access to the area is quite limited during the winter, the two construction periods (late May through October) would coincide with the primary recreational use of the area. There would be some visual impacts to hunters or other recreationists that do visit the site in the late fall, resulting from the drained reservoir and any trailers or material stockpiles left by the contractor. During the summer months, construction activities would be readily apparent to those passing by the reservoir on FDR 310 (see Section 3.9 for existing recreation uses). Since the campground would be closed during construction, there will be no short-term visual impacts to people using the campground.

Short-term visual impacts during construction would result from the activities and features listed below. It is unlikely that any of these activities would meet the "modification" VQO during the construction period. The exact impacts of each activity would depend on the final location and design of each feature.

- Structures required for the construction camp
- Materials stockpiles

- The concrete batch plant
- Staging areas
- Clearing activities for the expanded reservoir
- Clearing for other facilities (dams, campground, construction camp, spillway)
- Draining of the reservoir
- Earth moving and other types of construction equipment
- Excavation of borrow material
- Fugitive dust created by the above and other construction activities

In addition, the traffic generated by the project would create a visual change, as well as increased noise and dust levels, to those using or living along the proposed access route (Fish Creek Reservoir Road ,Buffalo Pass Road, and Strawberry Park Road). If construction proceeds, project-related traffic would be an estimated average of 15 vehicles per day round trip during mobilization and demobilization at the beginning and end of the construction seasons. Peak traffic during this time is estimated to be 30 vehicles per day round trip. Average daily traffic during the remaining period would be an estimated 7 vehicles round trip, with a peak of 15 vehicles. It is not expected that night lighting would be required during the project construction. If the contractor should fall behind schedule, night shifts and thus night lighting could be required, which could create a very short-term, adverse visual effect, depending on the type and intensity of lighting.

<u>Long Term Direct Impacts</u> - Long term direct impacts of Alternative B would be limited to the area in the immediate vicinity of the reservoir, including both the existing and proposed campgrounds, the proposed trailhead to Long Lake, and the portion of the Middle Fork of Fish Creek immediately downstream of the dam (approximately 1/2 mile in length). Approximately 1.3 miles of FDR 310 would have visibility to the project. The project would not be visible from Buffalo Pass, Fish Creek Falls, the Fish Creek Falls Trail, or Mount Werner.

Discussed below are the impacts on visual quality as seen from the six key viewpoints described in Section 3.11. The six viewpoints are all places that are frequented by a relatively large number of visitors and thus have a high level of sensitivity. Visual impacts visible from locations other than the key viewpoints are also discussed under "Other Direct Impacts."

<u>Viewpoint A Impacts</u> - Viewpoint A is located at the existing campground looking towards the dam. Since the expanded reservoir would inundate the campground, this exact view would not exist any longer when the reservoir is full. Figure 4-1 estimates how this view would appear from the surface of the reservoir at that point. The foreground trees and vegetation would all be inundated, as would the small islands, and the view of water would be greatly expanded. This larger expanse of water would be the most dominant visual change, contrasting significantly from the existing view. Such large bodies of water are not generally found within this portion of the forest, but since the reservoir's visual elements borrow from natural color, form, line and texture, it would meet the "modification" objective when the reservoir is full. Since water is generally considered a visually desirable element in the landscape, the increase in size of the reservoir by approximately 50 acres would be considered a beneficial visual impact.

Another beneficial impact would be the smaller drawdowns resulting from the project. The proposed outlet structure and remote operational control works would allow the City to release only the water it needs to meet demand, which is currently about 350 AF, or 19 percent of the existing storage capacity. The City currently releases between 1,000 and 1,200 AF, or approximately 65 percent of existing capacity. As water demand increases over time, drawdowns would increase, but this would happen with or without the project. With the project, the year 2010 storage

requirements for the City and Mt. Werner (2,990 AF) would represent approximately 72 percent of total storage capacity. Without the project, this level of demand would exceed reservoir capacity, resulting in a completely drained reservoir and water shortages.

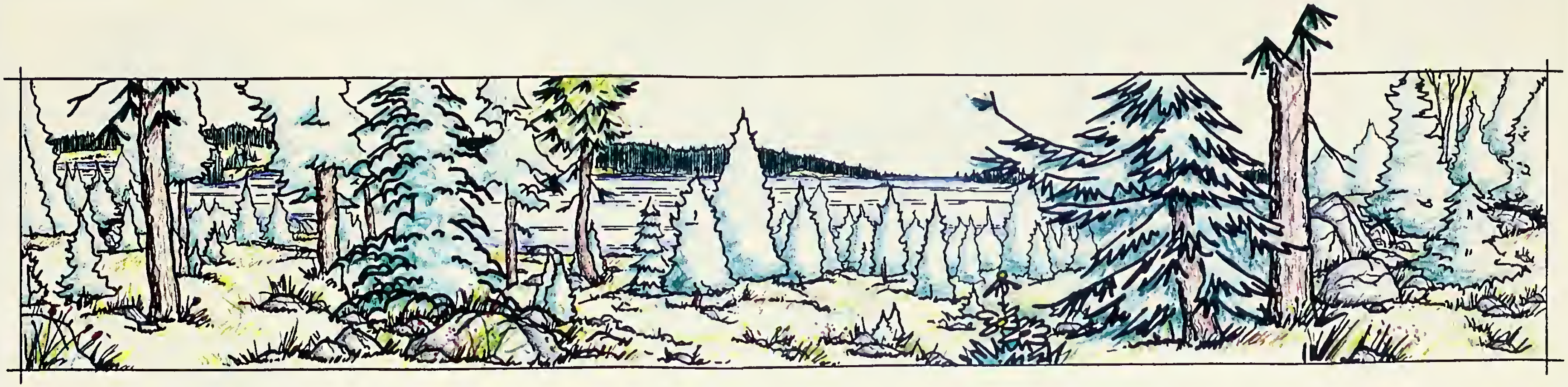
Although the project would reduce drawdowns over existing conditions, the drawdowns would expose additional shoreline and would not meet the "modification" VQO because of the contrast created in color and texture and its foreground location. During normal operations, the reservoir would be drawn down from August until spring runoff fills the reservoir, usually in late April or May. Most of the drawdown impacts would occur during August, since recreational use is significantly lower after Labor Day than during the summer months.

Under Alternative B, the dam would increase in length from 650 feet to 830 feet. The dam is located in the middleground from Viewpoint A (2/3 mile away) and thus the increased length would be readily apparent. Although the horizontal line of the dam is compatible with natural conditions, the form of the dam is much straighter than naturally established form, which would be accentuated by the longer dam. When the reservoir is full, the increased height of the dam would not be visible, since the freeboard would be the same as under existing operations. Since the dam borrows from naturally established line, color, and texture and is visually compatible with the surroundings from this viewpoint, it would meet the "modification" VQO. When seen as foreground, however, the dam would not meet the "modification" VQO because its contrasting form would dominate the view.

The proposed control building would also be subordinate to the overall composition of the view because of its relatively small size (10'h x 20'w x 15'd) and its distance from this viewpoint. The presence of background trees behind the structure would also help it blend in with the surroundings. As one approaches the dam along the shoreline trail or from the reservoir, however, the structure would become more apparent. Although its wood siding would be compatible with natural texture, the geometric form and vertical nature would contrast with the natural, rounded forms and the horizontal lines of the dam, treeline, and waterline. The structure would thus meet the "modification" VQO as viewed from Viewpoint A, because the scale is such that it would remain subordinate to the composition, but from closer points it would not meet this objective.

Viewpoint B Impacts - Viewpoint B is located at Campground Relocation Site 1 looking towards the water. Figure 4-2 indicates how this view would appear after completion of Alternative B. The primary change would be the larger expanse of water. Some of the foreground trees would be inundated, reducing some of the screening potential. As with viewpoint A, the expanded view of water would meet the "modification" objective when the reservoir is full, but with the reservoir drawn down, the "modification" objective would not be met.

It may also be possible to see the proposed borrow areas from this viewpoint. There would be a narrow band of borrow area, approximately 30 to 50 feet wide and 1.1 miles long, extending along the proposed reservoir shoreline that would not be inundated. Although the borrow areas would be reseeded with native grasses, they would not have the same mixture of rocks and vegetation of adjacent areas and thus would contrast with the natural texture. Borrow areas on the opposite shore would be in the middleground (approximately 1/4 mile away) and thus the disturbance may be difficult to detect, but the absence of trees from the area would be noticeable. Borrow areas on the north shore would also be visible from the campground, which would be in the foreground and thus more apparent. Any trees removed from borrow areas would further reduce screening.

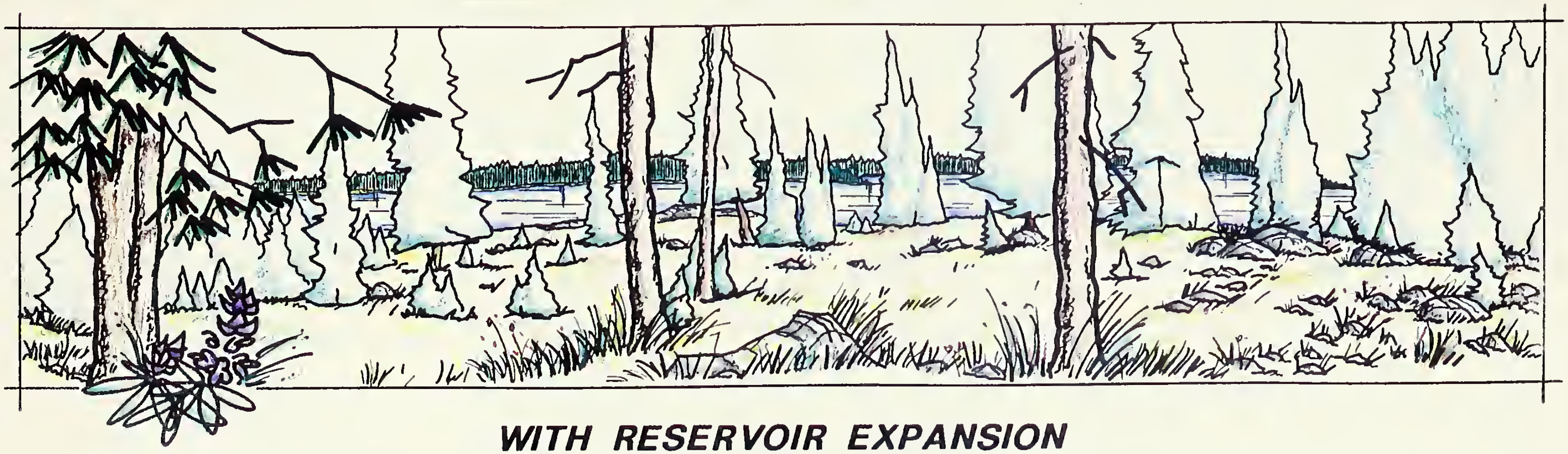


WITHOUT RESERVOIR EXPANSION

WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC4VA.DWG	Drawn By: M. MATHISEN	Date: January, 1993	
FIGURE 4-1			VIEWPOINT A - VIEW FROM EXISTING CAMPGROUND

WITHOUT RESERVOIR EXPANSION



WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC4VA.DWG	Drawn By: M. MATHISEN	Date: January, 1993	

FIGURE 4-2

VIEWPOINT B - VIEW FROM PROPOSED CAMPGROUND

Alternative B would inundate the existing access road visible from this viewpoint. If Road Corridor Option 3 is selected, however, the new access road may be visible. If visible, the road would not meet the "modification" visual quality objective, due to the contrasting color, texture, and line.

<u>Viewpoint C Impacts</u> - Viewpoint C is located on the Fish Creek Reservoir Road (FDR 310) near its intersection with the reservoir access road. Alterations within the FDR 310 corridor would need to meet the "partial retention" VQO, but the views of features located outside the corridor, such as the dam, would need to meet the "modification" VQO. Impacts from this viewpoint would be very similar to those of viewpoint A. The foreground vegetation and stream would be inundated, replaced by a large expanse of water (Figure 4-3). When drawn down, the reservoir would have similar impacts as viewpoint A. The new dam and control structure would also impact the view as discussed under viewpoint A. Borrow areas would most likely be visible in the foreground of this view, as discussed for Viewpoint B. There are no trees in the foreground, but there are existing shrubs that would be removed and replaced with grasses once the borrow area is reclaimed. Except during drawdowns, the project features from this viewpoint would meet the "partial retention" and "modification" VQO, assuming borrow areas are adequately reclaimed.

<u>Viewpoint D Impacts</u> - This viewpoint is located on FDR 310 near the Long Lake Trailhead, looking towards the reservoir. As with Viewpoint C, alterations within the FDR 310 corridor would need to meet the "partial retention" VQO. The primary impact from this viewpoint would be the proposed Road Corridor Option 2 route for the access road, located in the middleground (Figure 4-4). Within the east half (right side) of the view, there is no vegetation to provide screening.

The road would cross the existing meadow, contrasting with its form, line, and texture, and thus would not meet the "partial retention" VQO. It is possible that the Road Corridor Option 3 access route would be visible from this viewpoint, but it would be farther away than Road Corridor Option 3, and thus not as visually apparent.

<u>Viewpoint E Impacts</u> - This viewpoint is located at the existing campground access road looking towards Campground Relocation Site 1. Section 4-9 describes the facilities to be constructed. As with viewpoint A, this viewpoint would be submerged by the reservoir expansion, but provides an idea of what the campground would look like from the reservoir (Figure 4-5). The middleground trees would provide screening, although some trees would most likely be removed to construct the campground or to utilize the borrow area. A narrow strip of borrow area, approximately 20-30 feet wide, would be visible along the shoreline in front of the campground.

The campground would need to meet the "partial retention" visual quality objective, because it is close to the FDR 310 corridor. The campground itself would meet this objective, because it would remain visually subordinate to the surrounding landscape and would repeat natural form, line, color, and texture. This assumes that the campground composting toilet is designed in such a way to fit in with its surroundings. When the campground is fully occupied with tents and vehicles, however, it would be much more apparent as an introduced facility. The 15-car parking lot, the campground access road, and the boat ramp would also be readily apparent, as they would create contrast in terms of color and texture. The expanded campground and the facilities for vehicles would result in a less remote atmosphere at the reservoir by attracting more visitors and vehicles to the site. If the eight future campsites are developed, the uncrowded quality would be further reduced.

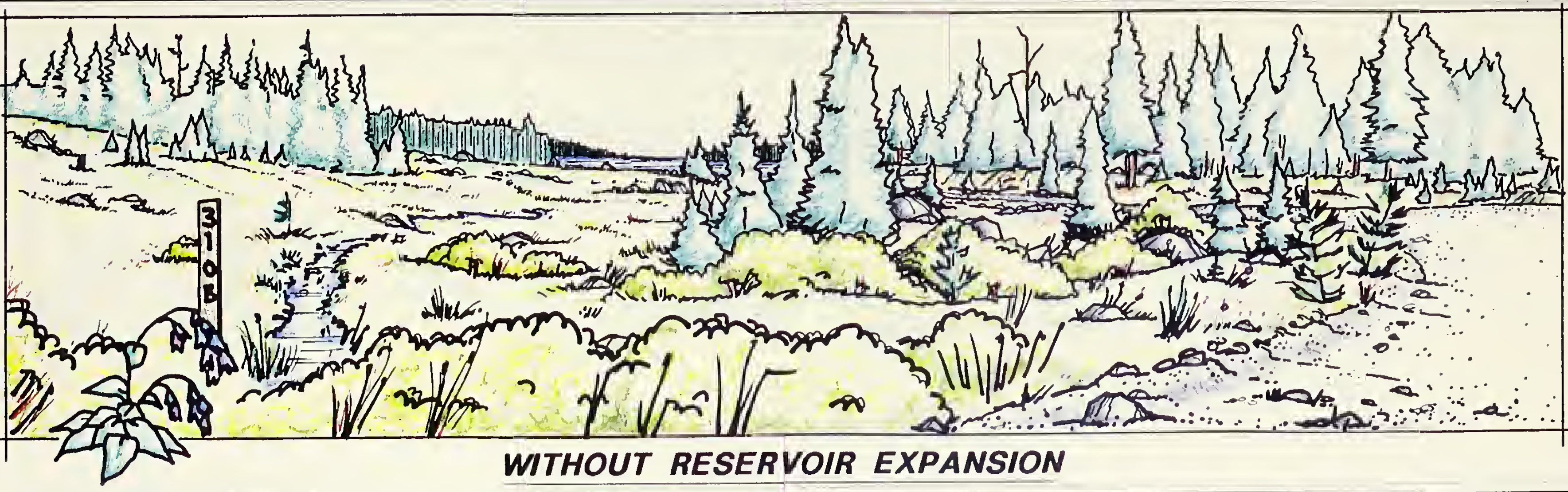
<u>Viewpoint F Impacts</u> - Viewpoint F is located on the north shore of the reservoir looking towards the proposed saddle dam (Figure 4-6). This viewpoint would also be submerged by the expanded reservoir. Figure 4-6 shows approximately how it would appear from the water surface after construction. The dam's height above normal water surface level would be the same as under existing conditions. The length of the saddle dam would increase from 400 to 1060 feet. The cut slope on the spillway's east side would most likely be the only aspect of the spillway visible from Viewpoint F. From the middleground view, the slope would be obviously man-made, but the existing rock outcroppings above the spillway would help blend the slope in with the background. The City plans to relocate the existing maintenance shed, since it is situated under the proposed dam.

<u>Other Direct Impacts</u> - The project would have a number of other direct visual impacts, in addition to the viewpoint impacts discussed above. One such impact would be the power cubicles located every 1,250 feet along the proposed underground powerline (Figure 2-5). The boxes would be visible along FDR 310 from its intersection with the Hayden-Cheyenne powerline to a point approximately one-half mile north of the reservoir access road. The boxes would not meet the "partial retention" objective established for the FDR 310 corridor, due to their contrast with natural form, line, and texture. A power cubicle would also be visible along each of the dams and from the reservoir shoreline, which would meet the "modification" VQO for the reservoir, since their small size would allow them to remain visually subordinate. Since most of the powerline itself would be installed within existing roadways, vegetation disturbance would be limited to the 2,300-foot portion not located within existing roadways, of which approximately one-half would be visible from the shoreline.

The views from Puppy Dog Lake and the Middle Fork of Fish Creek, looking upstream towards the saddle and main dams, respectively, would be altered as the dams increase in length and height. The main dam would be riprapped and the saddle dam would be either seeded or riprapped. The spillway would also be visible from Puppy Dog Lake, which would have either a riprapped or bedrock channel along the top half and a grass lined channel below. The side slopes would be grass or bedrock. Although the view of the spillway and dams from downstream would not meet "modification" VQO, the small number of visitors make this an area of low sensitivity.

A beneficial impact would be the old borrow areas to be reclaimed as part of the project. Another beneficial impact would be the stream channel rehabilitation proposed downstream of Puppy Dog Lake. Although not seen by many visitors, the existing erosion resulting from current reservoir operation represents a visual disturbance that needs to be repaired. The new outlet control works and spillway would prevent future erosion by reducing flows through Puppy Dog Lake.

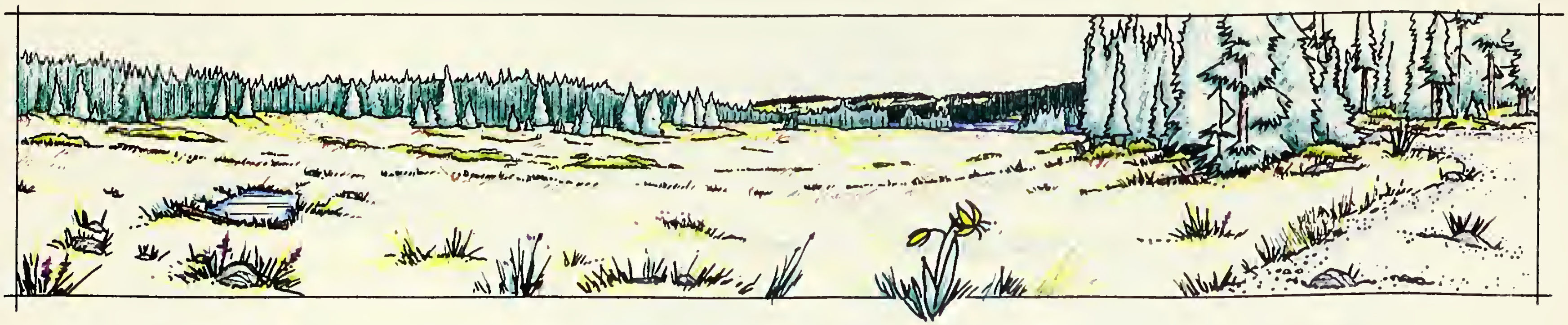
Impacts of Road Corridor Option 2 were discussed under Viewpoint D. Road Corridor Options 1 and 3 would also have visual impacts. Approximately 1/3 mile of Option 1 is routed along the existing trail to Long Lake. The clearing and grading required to convert the trail into a road would represent a visual change seen by the many recreationists that use the trail to access Long Lake and the Fish Creek Falls Trail. The disturbance, however, would be screened from view from other areas by trees and thus would have less visual impact than the other road corridor options. Option 3 would be visible from FDR 310 and probably from the north shore of the reservoir and Campground Relocation Site 1 as discussed under Viewpoint B. The proposed access road, regardless of its location, would not meet the "modification" VQO, since it would contrast in terms of line, color, and texture with its surroundings. All three road corridor options include rerouting 600 feet of the existing access road immediately east of the dam above the proposed water line and rerouting 1,000 feet of the existing road out of a clearing. Both of the rerouted segments would be screened from the surroundings by existing trees.



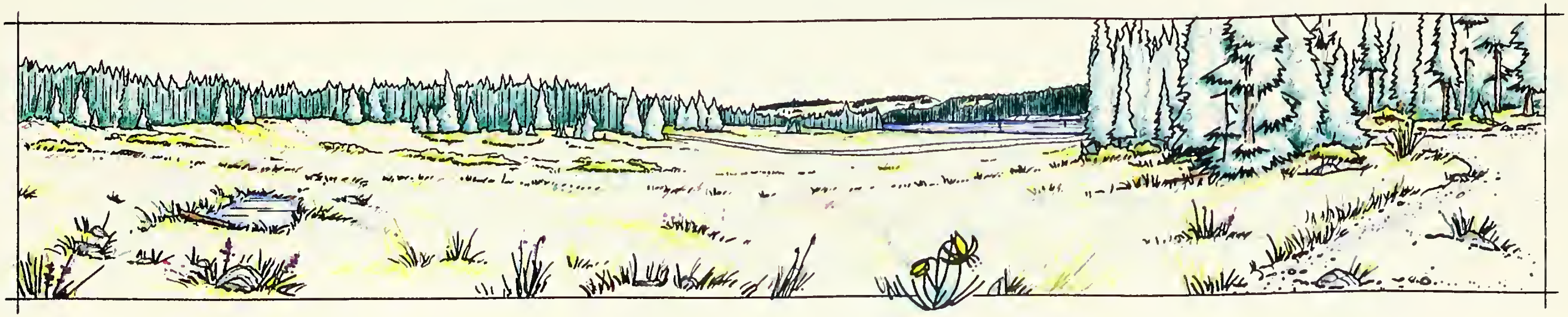
WITHOUT RESERVOIR EXPANSION

WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC4VC.DWG	Drawn By: M. MATHISEN	Date: January, 1993	
FIGURE 4-3			VIEWPOINT C - VIEW FROM FDR 310

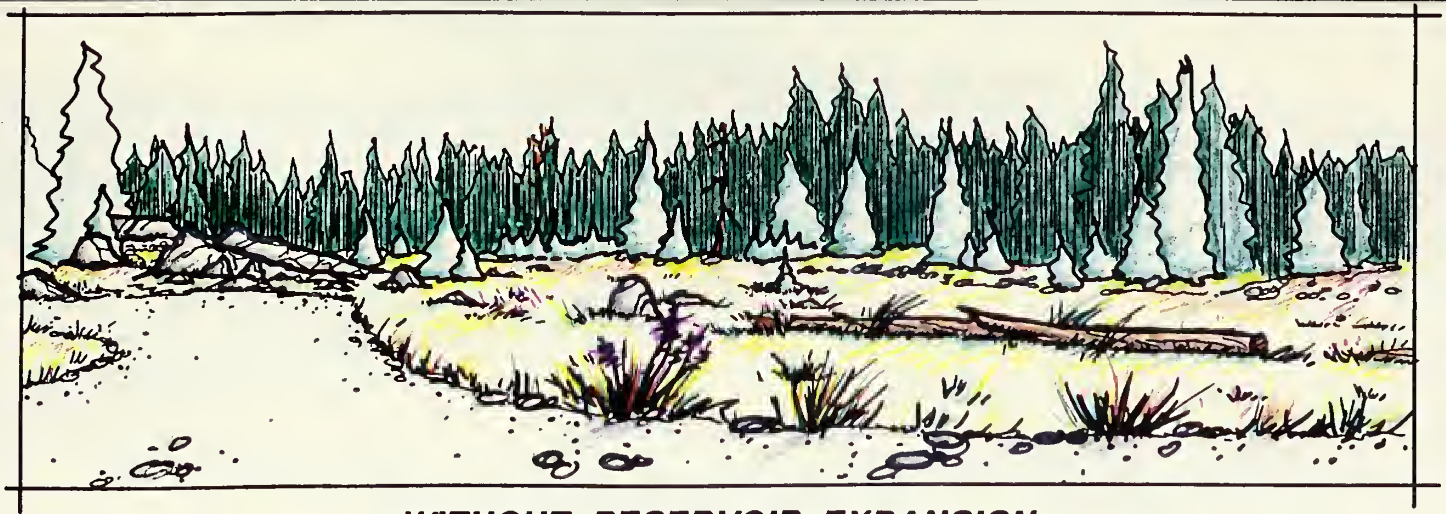


WITHOUT RESERVOIR EXPANSION

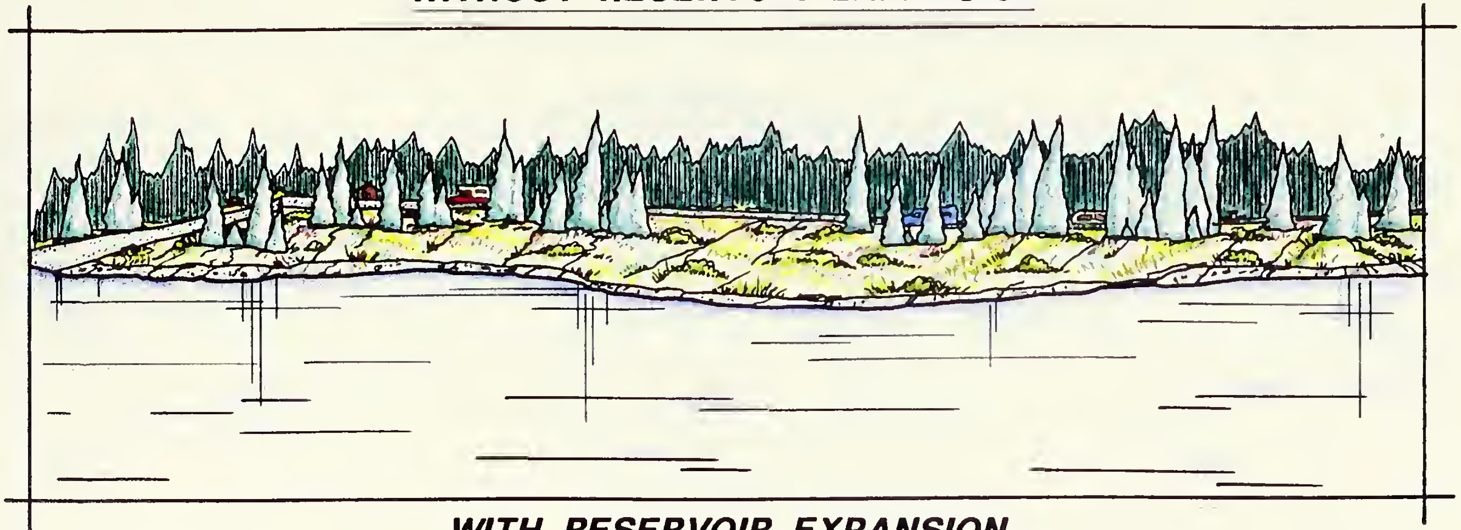


WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC4VD.DWG	Drawn By: M. MATHISEN	Date: January, 1993	VIEWPOINT D - VIEW FROM LONG LAKE TRAILHEAD
FIGURE 4-4			



WITHOUT RESERVOIR EXPANSION



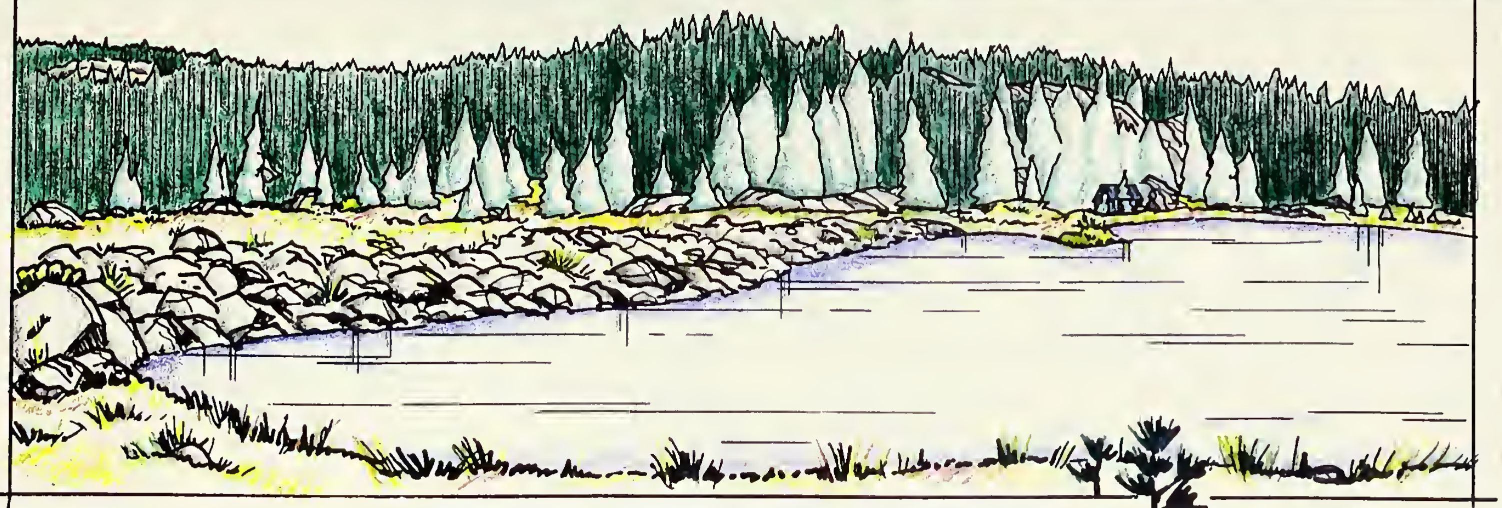
WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE
File: FC4VE.DWG	Drawn By: M. MATHISEN	Date: January, 1993

FIGURE 4-5

FISH CREEK RESERVOIR EIS

VIEWPOINT E - VIEW TOWARD PROPOSED CAMPGROUND



WITHOUT RESERVOIR EXPANSION

WITH RESERVOIR EXPANSION

Project No.: 828-1500	Design By: J. RAY	Scale: NO SCALE	FISH CREEK RESERVOIR EIS
File: FC4VF.DWG	Drawn By: M. MATHISEN	Date: January, 1993	
FIGURE 4-6			VIEWPOINT F - VIEW TOWARD SADDLE DAM

The Proponent may be required to create off-site wetlands to mitigate impacts. Since the exact locations of such efforts have not been finalized, their visual impacts cannot be determined. Any structures required for mitigation would thus need to be approved by the Forest Service prior to installation. Structures should be as compatible as possible with the form, line, color and texture found in the vicinity.

Indirect Impacts - As discussed under Alternative A (Section 4.11.2.1), low flows in Fish Creek downstream of the municipal filtration plant represent an existing visual concern. Fish Creek is an important natural feature within a tourist-oriented community, and thus the creek's aesthetic value is of concern to the City. The low flows can occur as early as July and often occur in August, both prime months for tourism. The remote operational control proposed as part of the project would give the City more flexibility in operating the reservoir and thus allow them to maintain the minimum flow of 2 cfs in the creek required by stipulation with the Colorado Water Conservation Board.

4.11.2.3 Alternative C - Smaller Reservoir Expansion

Short-Term Direct Impacts - The short-term impacts of Alternative C would be similar to those of Alternative B, primarily because the construction period would be the same for both alternatives. The magnitude of visual impacts from Alternative C, however, may be less in some respects than that for Alternative B due to the smaller scope of the project, but the lack of detailed construction plans makes it difficult to quantify. Material stockpiles, for example, may be smaller, as would borrow areas. Clearing should also be less extensive.

Long Term Direct Impacts - The long term impacts of Alternative C would be similar to those of Alternative B, but in some cases less extensive. The size of the reservoir would increase by only 22 acres (20 percent). The length of the main dam would be increased, but only by 100 feet (15.4 percent). Its height would increase by 8 feet (15 percent). The control building would be the same as for the Proposed Action. The length of the saddle dam would also be increased, but only by 400 feet (100 percent). The saddle dam's height would increase by 10 feet (63 percent). As with Alternative B, the increased height of the two dams would only be visible from downstream when the reservoir is full. As the reservoir is gradually drawn down, the increased height would become more visible from the reservoir. The proposed access routes would remain the same as for Alternative B, as would the proposed campgrounds and powerline. The compatibility of the above features with the Forest Service visual quality objectives is discussed under Alternative B.

The effects of drawdowns on visual quality would be greater with Alternative C than with Alternative B. The 2,990 AF withdrawal projected for the year 2010 would remove all of the reservoir's water, exposing the entire reservoir bottom and the full expanse of both the main and saddle dams.

The borrow areas may have greater impacts with Alternative C than with Alternative B. A smaller reservoir would inundate a smaller portion of the proposed borrow areas and thus expose more disturbed area to view. Over one-half of the borrow area, as currently proposed, would be exposed with the smaller reservoir, although it could be assumed that less borrow would be needed for a smaller reservoir.

<u>Indirect Impacts</u> - The stipulated agreement between the City and the Colorado Water Conservation Board would not pertain to Alternative C (see Section 4.3.2.3). The City, therefore, would not be required to maintain a minimum flow of 2 cfs. Visual impacts below the intake to the water filtration plant would be the same as these described under Alternative A.

4.11.3 Impacts Summary

Under Alternative A, the current visual nature of the Fish Creek Reservoir site would remain. Current visual conditions at the reservoir and low flow in Fish Creek would not be improved.

Alternative B would have both adverse and beneficial visual impacts. The most obvious beneficial impact visible from the campground and FDR 310 would be the increased size of the reservoir. Other beneficial impacts would include the rehabilitation or inundation of old borrow areas, the smaller drawdowns, due to remote operational control; and the stream channel rehabilitation downstream of Puppy Dog Lake. A beneficial indirect impact would be the maintenance of 2 cfs minimum flow in Fish Creek, downstream of the municipal treatment plant.

Short term adverse effects of Alternative B would occur during construction, which would not meet the Forest Service visual quality objectives of "modification" or "partial retention". Construction activities would be visible from FDR 310, a popular recreation route to Long Lake.

Under Alternative B, the most obvious long term adverse effect visible from Campground Relocation Site 1 and FDR 310 would be the increased length of the main dam. When viewed as middleground, however, the dam should meet the "modification" VQO. Other visual impacts include the campground, which would meet the "partial retention" VQO, and the borrow areas, which would meet the "modification" VQO, assuming they are adequately reclaimed.

Features that would not meet the "modification" VQO under Alternative B include the spillway and saddle dams as viewed from Puppy Dog Lake, the main dam and outlet control building when viewed in the foreground, the access roads, and the reservoir drawdowns. Only the latter two, however, would be visible from sensitive locations. Features that would not meet the "partial retention" VQO for the FDR 310 corridor would be the boat ramp, parking lot and the power boxes along FDR 310, all of which would be in areas of high sensitivity. Although Campground Relocation Site 1 meets the VQO, full use of the campground would lessen the area's uncrowded, relatively pristine atmosphere, as would any future campground expansion.

Most of the Alternative C impacts would be similar to those for Alternative B, but in some cases less extensive. Exceptions would be the borrow areas, reservoir drawdowns, and flow in Fish Creek below the intake to the water filtration plant which would have greater impacts with Alternative C.

4.11.4 Connected Actions

Forest Service plans to improve access and recreational facilities in the Buffalo Pass area, as described in Section 3.9, would result in more visitors to the reservoir, which would lessen the relatively pristine, uncrowded atmosphere of the reservoir.

4.11.5 Cumulative Impacts

The number of visitors to the reservoir has increased with time, as access has improved, and would continue to increase as the Forest Service further improves access and facilities and as the expanded campground is constructed as part of the proposed project. The increasing number of visitors alters the visual appearance of the area due both to the presence of more people, as well as more signs of human use, such as trails, litter, dispersed campsites, and disturbed vegetation.

4.11.6 Mitigation Measures

The following mitigation measures would reduce the adverse effects of the proposed project on visual resources. In general, their purpose is to increase the compatibility of the project features with the Forest Service visual quality objectives. Where possible, mitigation would be required by the Forest Service to meet visual quality objectives.

- **Buildings:** All final siting and design would be approved by the Forest Service. The outlet control building should be a neutral, non-reflective color. A medium olive color would enable the structure to blend in with the background trees as seen from the campground and FDR 310. A dark green would create too much contrast from areas where the structure would be seen against the sky, especially when backlit. Vertical siding would be more consistent with the vertical nature of the background trees than horizontal siding. Although rock facing would help the structure blend in with the dam, the use of painted wood siding should be more effective in blending the structure into the background, as viewed from the campground and FDR 310. The existing maintenance structure, should be relocated to a site that contains screening trees and that is not visible from FDR 310 or the proposed campground. Painting the structure a neutral, nonreflective color would help reduce its contrast with the surroundings. The campground's composting toilet should also have vertical wood siding, painted a neutral, medium-value color.

- **Access Roads/Parking Lot:** Road Corridor Option 1 would have the least adverse effects on visual resources. Roads should be located and designed to minimize cut and fill. The tops of cut slopes should be rounded to fit in with natural landforms. Vegetation would be planted to screen the access roads, parking lot and boat ramp from FDR 310.

- **Revegetation:** All ground disturbance would be revegetated as soon as possible after construction, including the powerline right-of-way. All roadway cut and fill slopes should be replanted as soon as possible with native plant materials.

- **Borrow Areas:** Particular emphasis should be placed on restoring the borrow areas near the proposed campground to a condition as close as possible to natural conditions. This could include planting with several different grass species and replacing rocks and small boulders to recreate the existing level of visual variety.

- **Construction Camp:** The construction camp should be located in areas that would be inundated or disturbed by other activities, such as the borrow areas. The construction camp should not be located in the proposed campground site to avoid disturbing existing vegetation.

- **Clearing:** Tree clearing associated with all project features, including the dams, roads, campground, and powerline construction should be minimized. The existing vegetation above the reservoir high water line and at the toe and sides of the dam should be retained, where possible. The edges of any tree clearing should be feathered, especially for access roads and the powerline.

- **Spillway:** Cut slopes in bedrock should have a broken-faced finish to increase texture. The spillway should be designed to match natural contours, where possible.

- **Power Cubicles:** Power cubicles should be painted a medium-value, olive green to blend boxes into surroundings. Screening would be required such that the Forest Service visual quality objectives are met.

- **Mitigation:** Any structures required for fish and wildlife habitat or for wetland mitigation should be designed to reduce contrast with natural form, line, color, and texture, such as the use of rock facing or striations on concrete structures.

- **Construction:** All construction-related debris should be removed from the site between construction seasons and at the end of construction. Fugitive dust problems should be minimized by the use of water or other Forest Service approved techniques, especially along the Buffalo Pass Road. Use of night lighting should be minimized.

4.11.7 Unavoidable Adverse Impacts

Under Alternative A, current visual conditions at the reservoir and low flow in Fish Creek would not be improved. Assuming effective mitigation as descried above, all facilities would be designed to meet Visual Quality Objectives under Alternatives B and C. One unavoidable adverse impact would be reservoir drawdown during late fall.

4.12 CULTURAL RESOURCES

4.12.1 Introduction

Cultural resources which could potentially be impacted by the proposed project were identified during the Class III Cultural Resources Inventory discussed in Section 3.12, Cultural Resources. According to this inventory, none of the five sites surveyed represent significant cultural resources.

4.12.2 Direct and Indirect Impacts

4.12.2.1 Alternative A - No Action

Under the Alternative A, the sites would be subjected to soil heaving and impacts caused by natural and human activities in the area.

4.12.2.2 Alternative B - Proposed Reservoir Expansion

As documented in the Class III Cultural Resources Inventory (MAC, 1992), it has been recommended that cultural resource clearance be granted for the proposed Fish Creek Reservoir expansion. Three aboriginal sites and two recent historical sites are within the project area, but all cultural resources have been evaluated as not significant and it has been recommended that they be considered not eligible for inclusion in the NRHP. It has additionally been recommended that no further archaeological investigations are necessary at these sites.

Survey strategies employed during the Class III inventory and limited testing (MAC, 1992) were adequate to discover all expected cultural resources. As a result, further work such as construction monitoring is not recommended. The State Historic Preservation Officer (SHPO) has recently concurred with this recommendation.

4.12.2.3 Alternative C - Smaller Reservoir Expansion

As aforementioned, it has been recommended that cultural resource clearance be granted for an expansion of Fish Creek Reservoir, if selected by the Forest Service.

4.12.3 Cumulative Impacts

No cumulative impacts would be associated with any of the three project alternatives.

4.12.4 Mitigation and Enhancements Summary

There would not be any mitigation necessary if Fish Creek Reservoir is expanded because none of the aboriginal or recent historical sites located within the project area represent significant cultural resources.

4.12.5 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts associated with any of the three project alternatives.

CHAPTER 5

LIST OF PREPARERS

CHAPTER 5 - LIST OF PREPARERS

5.1 ACZ ID TEAM

Jean Ray, ACZ Inc. - Project Coordinator, Water Resources, and Socioeconomics. B.S. in Biology and an M.S. in Civil Engineering with an emphasis in Environmental Engineering. Registered Professional Engineer in the State of Colorado with over 15 years of experience in engineering, environmental, water quality, and water resources analysis.

Rex Bell, ACZ, Inc. - Project Administrator and Socioeconomics. B.A. in Accounting and Business Administration. Over 12 years of experience in finance, accounting, and business management. Seven years experience in the environmental consulting business.

Alan Krause, ACZ Inc. - Dam Safety and Flood Hazard. B.S. in Geology from Pacific Lutheran University, M.S. in Engineering Geology from Mackay School of Mines. Geologic Engineer with over 15 years of experience in geotechnical engineering and environmental analyses.

Patrick G. Corser, ACZ Inc. - Dam Safety, Construction Safety, and Borrow Sources. B.S. and M.S. in Civil and Geotechnical Engineering. Professional Engineer with over 12 years of experience in geotechnical engineering and embankment design and construction.

Loren A. Labovitch, ACZ Inc. - Recreation, Socioeconomics, and Water Conservation. B.A. in Environmental Studies from the University of California at Santa Barbara. Environmental Technician with a broad background in a variety of environmental disciplines including hydrology, biology, sociology, natural resource management, urban planning, and environmental law.

Tom Leidich, ACZ Inc. - Transportation and Borrow Sources. B.S. in Mining Engineering from the Colorado School of Mines. Project Engineer with over 6 years of experience in mine planning, design of drainage and sediment control structures, and operation supervision.

Richard T. Burtell, ACZ Inc. - Project Alternatives. B.S. in Geology and M.S. in Hydrology. Hydrologist with 6 years of experience in hydrologic evaluations and environmental investigations.

Bob Peterson, ACZ Inc. - Conservation. B.S. in Geophysical Engineering from the Colorado School of Mines. Geologist and Geophysical Engineer with over 13 years of experience in mining, geotechnical, and environmental engineering; geologic and geophysical mapping; and environmental investigations.

Susan Ernst Corser, ACZ Inc. - Recreation and Visual Resources. B.A. and M.S. in Environmental Studies and Landscape Design, and an M.A. in Urban Planning. Landscape Planner with over 13 years of experience in landscape planning, visual impact analysis, and land management planning.

Tim Smith, ACZ Inc. - Field/Maps/Graphics. Associate Degree in Cartographic Drafting and has professional course-work in computer geologic modeling and computer programming. Computer Specialist with over 11 years of experience in drafting, graphics, and computer applications in the environmental and engineering fields.

Matt Mathisen, ACZ Inc. - AutoCAD Technician

Thorne Clark, ACZ Inc. - AutoCAD Technician

Cathy M. Carroll, ACZ Inc. - Word Processing

Kathy Olsen, Lotus Design. - Graphic Artist

Janet N. Shangraw, Hydro-Geo Consultants - Surface Water Hydrology. B.S. in Watershed Science/Hydrology. Certified Professional Hydrologist with over 12 years of experience in collection and analysis of hydrologic data, surface and groundwater studies and modeling, analysis of sedimentation and stream morphology, and evaluation of hydrologic impacts.

Vladimir Straskraba, Hydro-Geo Consultants - Flood Hazard. B.S. and M.S. in Geological Engineering from the Ostrava, Czechoslovakia School of Mines. Hydrologist with over 35 years of experience in hydrologic evaluations and water resources analysis throughout the world.

Noel Hobbs - Consultant, Water Resources and Conservation. B.S. in Civil Engineering. Registered Professional Engineer in the State of Colorado with 30 years of engineering experience focusing on extensive water rights and water resource planning and design for both public and private clients.

Steve Long, Cedar Creek Associates - Wetlands-Vegetation/Soils. B.S. in Wildlife Biology, an M.S. in Regional Resource Planning/Soil Science-Reclamation. Certified Soil Erosion and Sediment Control Specialist with over 17 years experience in the environmental field with 15 years of experience as corporate officer, project manager/strategist, revegetation specialist, soil scientist, revegetation field supervisor/coordinator, wetlands specialist, and vegetation/wildlife field technician.

T. Michael Phelan, Cedar Creek Associates - Wildlife/Fisheries. B.A. in Zoology from the University of California with postgraduate studies in biology and ecology from San Diego State University. Certified Wildlife Biologist with over 17 years of environmental, permitting, and NEPA experience.

Steve Viert, Cedar Creek Associates - Wetlands-Vegetation/Soils. B.S. in Wildlife Management, M.S. in Range Ecology, and an M.B.A. in Finance/Land Use Management. Certified Wildlife Biologist with over 15 years experience in permitting, range science, vegetation analysis, wetlands analysis, land use evaluation, impact analysis, and mitigation planning.

5.2 FOREST SERVICE ID TEAM

Wendy Schmitzer - Project Coordinator and ID Team Leader. EIS/Appeals and Litigation Coordinator for the Routt National Forest.

Sherry B. Reed - District Ranger of the Hahns Peak Ranger District, Routt National Forest. Recommending Official for this project proposal. B.S. in Wildlife and Fisheries Biology.

Leo Snowden - Transportation. Facilities and equipment manager for the Routt National Forest.

Elizabeth Sue Struthers - Cultural Resources. B.A. in Anthropology and a M.B.S. in Museology from the University of Colorado. Archeologist and cultural resource specialist for the Routt National Forest.

Michael Retzlaff - Socioeconomics. B.S. in Watershed Management and a M.S. in Economics. Land Management Planning Staff Officer for the Routt National Forest.

Tom Fratt - Fisheries, Wildlife, Wetlands. B.S. in Wildlife Management and Biology, and a M.S. in Natural Resources (Fisheries) from the University of Wisconsin.

Julie Anne McQuary - Recreation and Visual Resources. B.S. in Recreation and Park Administration from the University of Missouri and a Masters in Landscape Architecture (M.L.A.) from North Carolina State University. Fifteen years of professional experience in recreation planning and design and aesthetic resource assessment.

Ken Kowynia - Administration of Fish Creek Reservoir Special Use Permit. B.A. from the University of Denver and a M.F. from Colorado State University. Lands Staff for the Hahns Peak Ranger District, Routt National Forest.

Rob Schmitzer - Recreation and Transportation. B.S. in Forest Biology from Colorado State University. Recreation Staff Officer/Supervisory Forester for the Hahns Peak Ranger District, Routt National Forest.

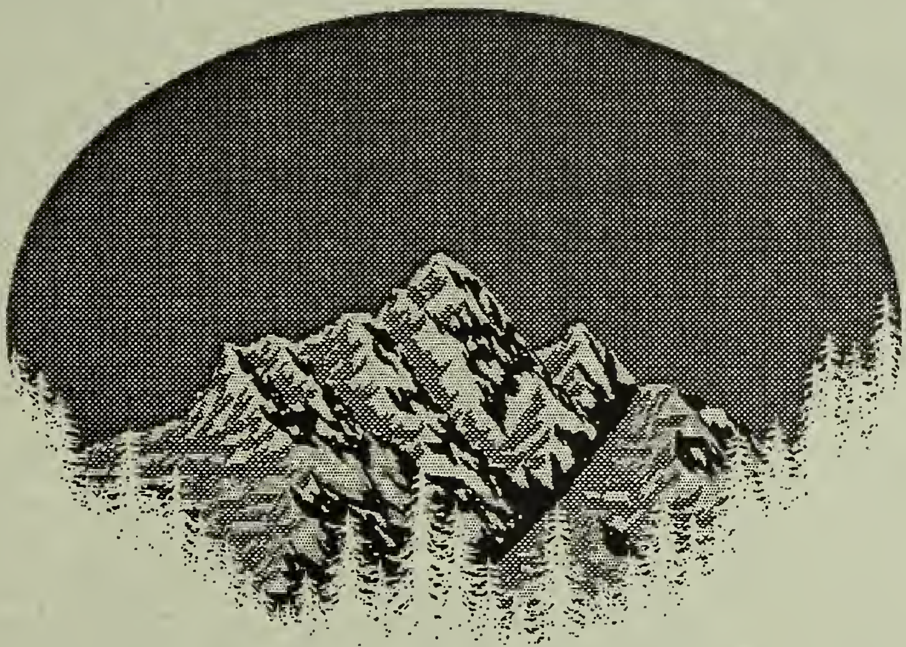
Neil L. Siettmann - Dam Safety and Construction; Flood Hazard. Graduate of the University of Wisconsin. Professional Engineer for the Routt National Forest.

Kirk N. Wolff - Water Quality/Water Rights/Conservation; Surface Water Hydrology; and Wetlands-Vegetation/Soils. B.S. in Forest Resource Management with an emphasis on Watersheds.

Trish Clabaugh - Need and Consequential Growth Impacts. B.S. in Recreation and Park Administration and a M.P. in Natural Resource Planning from the University of Wyoming. Social Scientist for the Routt National Forest.

CHAPTER 6

LIST OF AGENCIES, ORGANIZATIONS, & PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT



CHAPTER 6 - LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

6.1 FEDERAL AGENCIES

U.S. Environmental Protection Agency - Management Information Unit - Office of Federal Activities
U.S. Environmental Protection Agency - Region VIII
U.S. Department of Agriculture, Forest Service: Director of Environmental/Coordination
U.S. Department of Agriculture, Forest Service: Regional Office
U.S. Department of Agriculture - National Agricultural Library
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
Office of Environmental Affairs

6.2 STATE OF COLORADO

Colorado Department of Health, Water Quality Control Division
Colorado Department of Natural Resources:
- Colorado Division of Wildlife
- Colorado Water Conservation Board
- State Engineer/Colorado Division of Water Resources
- Colorado Geological Survey

Colorado State Historic Preservation Office

6.3 OTHER GOVERNMENT AGENCIES

Routt County Commissioners
Routt County Planning Department
Steamboat Springs City Council
Mt. Werner Water and Sanitation District
City of Steamboat Springs
Bud Werner Memorial Library

6.4 INDIVIDUALS

John Adams
Dale Baker
Mix Beauvais
Sally Bostrom
Joe Brennan
Wayne Chase
Jim Chubrilo
Gene Cook
Pat Davey
Joanna Dodder
Bob Enever
Al Fox
John Geddie
J. Mark Halvorsen

Dean Hitchens
Roy Hugie
John Hunt
Michael J. Korinek
Brian Len
Anthony B. Lettunich
Thomas Lichtenfels
Mark McElhinney
Dave Meyring
John Morrone
Robert Moss
Emmett K. Olson
Mark Palmer
Chuck Porter
John Ross
William Gary Shaw
John Spezia
Arienthe Stettner
Bob Stine
Russel & Shirley Thornton
Rich Tremaine
Don & Rita Valentine
Gigi & Johnny Walker
M.B. Warner
Robert G. Weiss
Loris Werner
Craig Wheeless
Frederick D. Wolf

APPENDICES

APPENDIX A

PUBLIC COMMENT LETTERS

Fish Creek Reservoir Proposal
Public Meeting Agenda
March 18, 1992

Thank you for participating in our community meeting tonight! We realize that your public lands are of particular interest to you. We are glad to provide this opportunity for you to become familiar with the analysis process and become aware of the project proposal.

The meeting tonight has been designed to provide everyone with an opportunity to get a good understanding of the proposal and an atmosphere to ask questions--either one-on-one with proposal proponents (City of Steamboat Springs and Mount Werner Water and Sanitation District), or in a meeting format. Below is the agenda for the evening.

7:00 - 7:15 **Open House** - Project Proponents and Forest personnel are set up with proposal maps and supporting handouts to assist you in your understanding of the analysis process and the project proposal. Feel free to converse with them as you wish.

7:15 - 8:00 **Proposal Presentation** - An introduction of players, roles and responsibilities, and a more formal presentation of the analysis process and the project proposal.

8:00 - 9:00 **Questions and Answers** - This is an opportunity for everyone to ask specific questions about the proposal and to raise any issues that may concern you. It is an opportunity for us (the Forest Service) to solicit your thoughts and concerns about any aspect of the proposal. We will also be asking that you provide written comments (which are the most helpful in this process).

We will all be available after the meeting for discussion.

As mentioned, we have found that written comments are the most effective form of input in this process. Now that you have had an opportunity to get acquainted with the details of the proposal, we would like to hear your thoughts and concerns about the proposal. In an effort to conserve paper please utilize the back of this agenda for your written comments. You may either give them to us before you leave or mail your responses to:

Sherry B.Reed, District Ranger
Hahns Peak Ranger District
P.O. Box 1212
Steamboat Springs, CO 80477

If you wish to be added to our mailing list for this project and future Forest projects, please provide us with your name and address.

Again, thank you for coming and assisting us in our mission of managing your National Forests for multiple uses in your best interest.

COMMENT SHEET

COMMENTS

Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

Is the need to provide water for projected growth?
1 If so what is the overall effect on all of the
existing water and sewer and roads etc. Who
2 will continue to foot the bill and when
will the valley "max out" environmentally and
3 will all pay by sacrificing "quality of life".

Would you like to be on this project mailing list? yes no
Name and address (Please Print):

Please send copy of conceptual plan

COMMENT SHEET

COMMENTS
Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

Issue clarifications: suggest

1 o Impact of cost of projects on fixed-income residents, and on the future demographics of the valley. I think this was Gene's concern.

2 o Impact of project on wetland values & other environmental values - should assess, evaluate, and address concisely and completely in the EIS

3 o Metering !!! cost, impacts for future water cost, factor in the savings of environmental values also!

4 o Are golf courses being watered by treated water??? Address this & other watering needs that could be met with non-treated (river?) water - assess savings in all accounts, same as for metering.

5 o Relate water rights, uses & losses, potential losses of rights to this project.

Would you like to be on this project mailing list? yes no
Name and address (Please Print):

Nick Mezei
Corps of Engineers
402 Rood Ave. Rm 142
G. J. CO. 81501
243-1199

Suggested wording for issue

#11. Adequacy of alarm system and evacuation plans in the event of a break in the dam.

Bob Enever
Box 239 80477
879-2017

COMMENT SHEET

COMMENTS

Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

1 My primary concern is : How necessary is the expansion, and, if the expansion does occur, where will the water be allocated, and how much grwoth will the expansion accomodate? (i.e. - twice the existing population?) It seems that there is not a great deal of space to be developed within the city limits, but that there are areas which will undoubtedly be developed on the mountain.
2 Therefore, those areas should be responsible for the majority of the proposed expansion costs. If the expansion is indeed necessary to insure the availibility of water to the existing population, I suggest an increase in size that would also accomodate a limited amount of growth. I do not want to see the population of Steamboat double, and if there are limited supplies of water, that level of growth will be impossible. Of course, they might just want to increase the size of the reservoir again, but we can deal with that when the situation arises. I also do not feel that we should increase water storage for the purpose of releasing more water into Fish Creek with the goal being to appease the aesthetic senses of summer tourists. If they want to see streams with a consistent year-round flow, they can go to Disneyland. Along the same lines, I feel there are plenty of of good fishing sites in the vicinity, and to increase flow to appease a few fishermen (probably tourists) would not be in the best interests of the community at large. (I am not denying the importance of tourism in the Steamboat area, but they usually spend about 7 days here, while the locals spend about 365, so I feel our interests come first) Whether the expansion takes place or not, an adequate safety/early warning device(s) should be installed at the dam. Lastly, where will water come from for proposed projects like the Catamount development and the golf course at the 40-131 intersection? Thanks.

Sincerely,

M.J. Korinek
P.O. 773630

SBM
Wendy WS
Ken KK
File

Would you like to be on this project mailing list? yes no
Name and address (Please Print):

MAR 1992

COMMENT SHEET

COMMENTS
Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

I have been involved in local politics for the past 12 years & I have a good grasp of the issues surrounding the Fish Creek Reservoir expansion. I am also ~~[illegible]~~ acutely aware of the pressures on the City to serve the area of Steamboat II (existing & filing III) and the necessity for low & moderate income housing. Unless the City expands its ability to deliver water, these issues of housing will go unresolved. As a resort community almost entirely dependent on tourism, it is essential that we have the water available for golf courses & landscaping amenities to make the area attractive. Landscaping & golf courses may seem like a non essential item in terms of vital municipal needs but in a resort economy these things are not luxuries they are as essential as good transportation is to a manufacturing community.

I am familiar with the area to be flooded & it seems to be of low impact from an environmental point of view, requiring no new roads & altering land areas of little value to flora & fauna.

This community could be crippled without this expansion to the water system.

[illegible]

Would you like to be on this project mailing list? yes no
Name and address (Please Print)

SBK
Sherry KK
Ken WS
Wendy
F.U.

Wendy WS

?/16. 92

Dear Ms SBR/Reed;

As for the Fish Creek Reservoir expansion, I want to know where the water will go if the dam breaks wide open. I have a house at 316 3rd Street. If it can be flooded by the larger dam, The value of the house goes down and the insurance goes up!

Therefore, unless you can garentee my house won't be flooded or show some significant benefit that outways risk, ~~I~~ I am against any expansion of the dam. I feel Steamboat has adequate water now.

Sincerely,
Dean Hitchens

MAR 1992

Dean Hitchens
22220 W. US 40
P. O. Box 8
Milner, CO 80487

P.S. Why are Forest Service personel offices in Steamboat? Shouldn't they be ~~in it~~ overseeing the district of Hahn's Peak

3-16-92

Sherry Reed
District Ranger
Hahns Peak Ranger District
P. O. Box 771212
Steamboat Springs, Co. 80477

Dear Ms. Reed: SBR

I am not overjoyed by the proposal to enlarge Fish Creek Reservoir (bigger is not always better), but I understand that these kinds of things are sometimes necessary, or at least expedient. And there's even the chance that it will be an improvement.

I would, however, request that if it is necessary to move the existing campground, that the new one be constructed with the same priorities and amenities as the old one-- especially that no drive-up campspaces be added. Fish Creek Reservoir is my family's favorite camping spot, and we use it every summer. We especially like the fact that everyone has to park their cars and carry their camping gear 50 - 100 yards. I know that's not much, but it ensures that there are no RV's or generators next to our tent. And we can let our two small children play without worrying about traffic through the campground.

There are enough RV and drive-up campsites at Summit, Pearl, Steamboat, and Hahn's Peak Lakes. Please try to preservce the uniqueness of Fish Creek Reservoir.

Sincerely,

Wm Gary Shaw

William Gary Shaw
P. O. Box 772776
Steamboat Springs 80477

Wendy WS

MAR 1992

Wendy WS

John Spez
Box 2255
Steamboat
Springs, Co
80477

March 17, 1992

SBW
Sherry Reed,

I regret that I cannot attend the public meeting on March 18th as I have to work that night. Please include these written comments in your testimony.

It has been suggested that we need more water in fish creek to protect the fishery of fish creek. The solution; build a higher dam. Why is there less water in
1 Fish Creek? (Inefficient use of water). In
2 low years of water many fish move down to the Yampa. The fish seemed to have done well for 1000's of years in the past, why all the concern now to build a dam for their needs. In fact, the past dams have probably caused more harm to the fish (increased water temperature, change in chemical make up and sediment flow).

Another point made for the dam is to meet the needs of the Annexation of west Steamboat and affordable housing. Again, why do we need more water when water efficiency will generate several magnitudes more water than a dam. The city and Mt Werner water district have installed water

meters in all businesses and homes for at least two years, yet the promoted water conservation program and use of these meters has been stalled by those who will have to pay for the amount of water they use, where as now, all users paying for waste and inefficiency. The idea of, the more you use the less it cost management of our water, has to
3 stop. More water, in the form of a raised dam, does not promote conservation, it promotes waste... supply & demand theory!

Before any discussion or implementation of a new dam, we need to implement cost effective, conservation saving management to use what we have properly.

There are two resources that are limiting factors in this Valley. One is water, which
4 we must conserve not waste, The other is local people which we will be driven out if we raise taxes & buy bonds to pay for a new dam we dont need. We have all the water we need, if we use water meters and make people pay for what they use. 35,000 gallons per month for a family of 4 is ridiculous!

Sincerely

John Spezia

MEMORANDUM OF CALL

Previous editions usable

TO: ~~KV~~ WENDY - FOR YOU!

☐ YOU WERE CALLED BY– ☐ YOU WERE VISITED BY–

Russel + Shirley Thornton

OF (Organization)

☑ PLEASE PHONE ▶ ☐ FTS ☐ AUTOVON

879-4691

☐ WILL CALL AGAIN ☐ IS WAITING TO SEE YOU

☐ RETURNED YOUR CALL ☐ WISHES AN APPOINTMENT

MESSAGE

Definitely "no" on Fish Creek Expansion. Cannot make it to the meeting tonite, but wanted to let you know. Call if questions

RECEIVED BY	DATE	TIME
AM	3/18	3³⁰

63-110 NSN 7540-00-634-4018 STANDARD FORM 63 (Rev. 8-81) Prescribed by GSA FPMR (41 CFR) 101-11.6

★U.S.GPO:1985-0-461-274/20021

OVER

3/18/92

JOHN O. ROSS
P.O. BOX 1766
STEAMBOAT SPRINGS, CO 80477

MAR 1992

Sherry Reed, District Ranger
Hahn's Peak Ranger District
P.O. Box 771212
Steamboat Springs, CO 80477

Dear Sherry,

Thanks for sending out a notice about the Scoping Meeting on the Fish Creek Reservoir Expansion. I have previously scheduled a meeting for that evening, and appreciate the opportunity to make written comments.

My concerns about the project are as follows:

SAFETY- In considering safety issues, in this case failure of the dam, it seems appropriate to assume a worst case scenario. During 4th of July weekends there is the potential for a disaster with hundreds, and maybe thousands of visitors in town and the Reservoir full. Failure of the dam then would require established and rehearsed evacuation procedures, equipment and personnel to carry out the procedures. A few years ago some Colorado State University students did a survey of just such a dam failure with the existing dam and found that the evacuation time would be less than 30 minutes. To my knowledge, neither the City of Steamboat Springs nor the Mt. Werner Water and Sanitation District has developed and rehearsed any evacuation procedures for the present Resevoir even though the subject was featured in a Steamboat Pilot article a few years ago. Installation of a solar powered early warning system alone certainly won't protect the populace from such a disaster; it will only tell them it's coming so that the presently non-existant evacuation procedures can begin.

WETLANDS- Not knowing the extent of wetlands potentially affected, I can't comment specifically. In general, any wetlands in the Fish Creek watershed are purifying the water we treat in Steamboat Springs and the loss of water quality from wetlands destruction could be critical.

NEED- Steamboat's Assistant Public Water Director, Mr. Dan Birch, is quoted in the Steamboat Pilot as stating that the City of Steamboat Springs has enough water for the forseeable future.

As I see it, the reasons for the proposed reservoir expansion are that the Mt. Werner Water and Sanitation District has no storage water rights in the present Fish Creek Reservoir and must rely on the City's storage water

rights in order to both pipe approximately 2 c.f.s. onto the Sheraton's golf course and meet their other water supply requirements. It doesn't make sense that the City should be talking about paying for 40% of the expansion cost when the City is already providing storage water for Mt. Werner Water and Sanitation District to meet their obligations.

The second reason, given by Mr. Dan Birch in a recent Steamboat Review article is to meet future needs such as Steamboat II, West Water and Sanitation District needs, and employee housing. To me this is ludicrous. We all know that, in the water short western states, when some governmental body creates a water supply at taxpayer's expense, some private operation will put the water to use at a cost far below what the water costs the taxpayers: another hidden public subsidy for a private operation.

I agree that having a live creek all year would have many advantages, and a minimum stream flow should be designated for that purpose so long as public money is funding the expansion and Fish Creek is accessible to the public below the existing Water Treatment plant, or at the least through the golf course property since that's the property that would receive the most benefit from a minimum stream flow and it's not residential or commercial property. There is certainly no sense in having the City pay for a public facility without the taxpayers who fund it having access: otherwise this public funding would largely be for the benefit of the Sheraton golf course and the Sanctuary/Mountain View Estates Filing III developments which border or are near Fish Creek.

<u>WATER RIGHTS & USE</u>- Enclosed is a copy of the Water Rights from Fish Creek in order of Priority. It shows clearly that there are plenty of water rights which might be used with more water available if Fish Creek had more Reservoir Storage. Should the expansion be done with the City paying any part of the Project, I think the City and the Mt. Werner Water and Sanitation District must be restricted to having the water used <u>only to serve</u> the present confines and boundaries of the City of Steamboat Springs and the Mt. Werner Water and Sanitation District, and other water rights wil not be benefited. If the City at some time developes a golf course which would use some of this additional water, it could certainly do so as long as the golf course is open to the public.

My concern over the location of use arises from the existing practise of the City letting Mt. Werner use some of the City's existing storage rights which in fact were obtained and built by the City and not Mt. Werner Water and Sanitation District. With this precedence, there should be no chance for any City Council or Administration or the Mt. Werner Water and Sanitation District to sell water to places like Arizona, California, Lake Catamount Area, or development in the Yampa Valley between Steamboat Springs and Lake Catamount.

PHILOSOPHY- Civilization in the dry western states depends upon water storage. This is a diminishing supply due in part to the silting in of reservoirs. As a result water planners speak of reservoir lifetimes without any plans to replenish the water quantity being lost by siltation. Essentially we have and are creating huge populations and enterprises which are predestined to extinction if funds are not accumulated and designated for dredging and/or replacement storage facilities. Without such plans and the means to implement them, our water planners and managers can continue to pat themselves on the back by saying "This will be a 100 year reservoir" without any thought about what happens to their descendents and the public's descendents after 100 years.

CONSERVATION- Since the City and Mt. Werner Water and Sanitation District have done almost nothing to implement water conservation measures, there isn't any way to determine actual need, if any really exists. Projections can be made based upon water usage in front range cities, but they don't have the large, seasonal transient population that uses a ski resort like Steamboat. Wanting to more than double a water storage capacity before conservation measures are even developed makes no sense to me.

I would appreciate being placed on your mailing list for this project. Thanks for the opportunity to comment.

Yours Truly,

John O. Ross

John O. Ross

WATER DISTRICT 58 - FISH CREEK PRIORITY LIST

AdminNumber	ID	STRUCTURE NAME	COURT NO	AMOUNT	USES	COMMENTS	STRUCTURE TOTAL
14466.00000	642	FISH CR MUN WATER INTAKE	82	2.00 CFS	2	STEAMBOAT SPGS. FROM HOYLE & KNIGHT CA3870, W807, 81CW32	2.00
14466.00000*	642	FISH CR MUN WATER INTAKE	82	5.12 CFS	MANY	FISH CK-MT WERNER. TF HOYLE & KNIGHT W5, W959	7.12
14466.00000*	642	FISH CR MUN WATER INTAKE	82	0.18 CFS	2	FISH CK-MT WERNER & STEAMBOAT SPGS. TF HOYLE & KNIGHT 87	7.30
14466.00000*	697	HOYLE & KNIGHT D	82	1.00 CFS	1	7.124 CFS TO FISH CK PL W5, W959. .176 CFS TT FISH CR MU	1.00
14762.00000	675	HANGS DITCH	(86)97	1.30 CFS	1	LITTLE FISH CK	1.30
18849.00000	607	DELONGE KELLY D	160	4.00 CFS	18	NORTH FK of FISH CK	4.00
19985.18830	505	ALBERT A MANN D	159d	0.37 CFS	1569	FISH CK-TF WELCH & WATERS D CA2412 CHANGE USE 89CW128	0.37
19985.18830*	642	FISH CR MUN WATER INTAKE	159d	1.30 CFS	78	FISH CK-STEAMBOAT SPGS. TF WELCH & WATERS CA1505, W807,	10.34
19985.18830*	642	FISH CR MUN WATER INTAKE	159d	1.74 CFS	1	FISH CK-MT WERNER. TF WELCH & WATERS W959	3.04
22438.22048	642	FISH CR MUN WATER INTAKE	189a	2.56 CFS	1	FISH CK-MT WERNER. TF HOYLE & KNIGHT W959	12.90
22544.22156	642	FISH CR MUN WATER INTAKE	191D	3.42 CFS	1	FISH CK-MT WERNER. TF WELCH & WATERS W959	16.32
23646.15888	815	PARK CITY MAIN LAT 1	123aaa	0.33 CFS	1	FISH CK-PARK CITY DECREE FROM ALBERT A MANN D W318	0.33
23646.21742	505	ALBERT A MANN D	188 1/2	1.33 CFS	1569	FISH CK-CHANGE OF USE 89CW128	1.70
23646.22531	505	ALBERT A MANN D	213	0.66 CFS	1569	FISH CK-CHANGE OF USE 89CW128	2.36
25392.21742	505	ALBERT A MANN D	188b	1.25 CFS	1569	FISH CK-CHANGE OF USE 89CW128	3.61
26805.26495	642	FISH CR MUN WATER INTAKE	251	1.50 CFS	78	FISH CK-STEAMBOAT SPRINGS. TF FISH CK PL W807, 81CW320	17.82
29687.18485	606	DELONGE D	160a	0.17 CFS	1	LITTLE FISH CK	0.17
33782.19875	507	ALMA M BAER FEED DITCH	290	0.37 CFS	1	FISH CK	0.37
33782.19875*	3501	ALMA M BAER RES	291	2.59 AF	68	FISH CK	2.59
33782.23124	3522	LONG LAKE RES	306	395.60 AF	1248	SOUTH FK of FISH CK	395.60
33782.33648	3508	FISH CREEK RES	351	1175 AF	128	MIDDLE FK of FISH CK	1175
34546.00000	642	FISH CR MUN WATER INTAKE	357	2.10 CFS	1	FISH CK-MT WERNER. TF WELCH & WATERS W959	19.92
35320.33181	642	FISH CR MUN WATER INTAKE	384	3.00 CFS	18	FISH CK-STEAMBOAT SPGS. TF BATTON & BATTON HG NO2 W1414	22.92
35320.35215	642	FISH CR MUN WATER INTAKE	388	3.70 CFS	18	FISH CK-STEAMBOAT SPGS. TF BATTON W1414	26.62
37688.28397	642	FISH CR MUN WATER INTAKE	412	1.00 CFS	9	FISH CK-MT WERNER. TF HOYLE & KNIGHT W959	27.62
37688.33723	642	FISH CR MUN WATER INTAKE	417a	1.00 CFS	9	FISH CK-MT WERNER. TF HOYLE & KNIGHT W959	28.62
39254.20223	815	PARK CITY MAIN LAT 1	3	0.30 CFS	18	FISH CK-.4 CFS TT FISH CK PARK WELL #1 & .3 CFS TT WELL	0.63
39254.20223*	5047	FISH CK PARK WELL NO 1	3	0.40 CFS	278	FISH CK-TF PARK CITY NO 1. ACTUALLY ALT PT OF DIVERSION	0.40
39254.20223*	5048	FISH CK PARK WELL NO 2	3	0.30 CFS	278	FISH CK-TF PARK CITY NO 1. ACTUALLY ALT PT OF DIVERSION	0.30
39599.00000	2127	FOUR COUNTIES WATER	40	210.00 CFS	28	(COND) WATER T.T. COLO UTE. DILIGENCE 84CW53,88CW49. UYW	210.00
40329.00000	507	ALMA M BAER FEED DITCH	46	1.50 CFS	1	FISH CK	1.87
40406.00000	3508	FISH CREEK RES	47	666.63 AF	2	MIDDLE FK of FISH CK	1842
41457.00000	642	FISH CR MUN WATER INTAKE	59	1.00 CFS	1	FISH CK-MT WERNER. TF PARK CITY NO 2 W959	29.62
41727.23892	1058	WELCH SPRING 2	5B	0.070 CFS	189	LITTLE FISH CK	0.070
41727.23892*	1059	WELCH SPRING 1	5	0.033 CFS	189	LITTLE FISH CK	0.033
41727.41412	2127	FOUR COUNTIES WATER	C45	363.00 CFS	28	FISH CK-(COND) WATER T.T. COLO UTE. DILIGENCE 84CW53, 88	573.00
41851.00000	642	FISH CR MUN WATER INTAKE	50	3.50 CFS	128	FISH CK-STEAMBOAT SPGS. TF FISH CK PL W807, 81CW320	33.12
42156.00000	642	FISH CR MUN WATER INTAKE	52A	1.16 CFS	128	FISH CK-MT WERNER. TF MT WERNER PL W959, 79CW89	34.28
42156.00000*	642	FISH CR MUN WATER INTAKE	52B&C	2.70 CFS	128	MT WERNER. TF MT WERNER PL W959,79CW88&89. MADE ABS W105	36.98
42159.00000	974	CARROLL ELKINS SPG & PL	47	0.030 CFS	8	LITTLE FISH CK	0.030
42211.00000	4226	PHASE 3 RESERVOIR	C54	308.10 AF	158	(COND) DILIGENCE 84CW161, 88CW145 (THIS DECREE HAS LOTS	308.10
42216.00000	1056	TUCK SPRING & PL	57	0.010 CFS	189	LITTLE FISH CK	0.010
42925.00000	5001	GREEN WELL & PL	70	0.50 CFS	189	FISH CK	0.50
44559.20223	815	PARK CITY MAIN LAT 1	W317	1.67 CFS	19	FISH CK	2.30
44925.41829	5012	CLAYSON WELL 1	W425	0.25 CFS	1	FISH CK	0.25
45290.44752	1249	MORRIS SPRING	W689	0.010 CFS	8	LITTLE FISH CK	0.010
45655.40703	1250	FISH CREEK SPG 1	W911	0.034 CFS	8	NORTH FK of FISH CK	0.034
45655.40703*	1250	FISH CREEK SPG 1	W911	0.97 CFS	8	NORTH FK of FISH CK-(COND) DILIGENCE 81CW211	1.00
46097.00000	4356	DINOSAUR LAKE MLL	W1041	130.50 AF	6	NORTH FK of FISH CK	130.50
46652.00000	1351	NORTH FK FISH CK MSF UP	W1369	2.00 CFS	M	NORTH FK of FISH CK-HEAD WATERS TO MID FK FISH CK.	2.00
46652.00000*	1490	MIDDLE FORK FISH CK MSF	W1372	2.00 CFS	M	MIDDLE FK of FISH CK-HEAD WATERS TO FISH CK RES	2.00

03/11/92

AdminNumber ID	STRUCTURE NAME	COURT NO	AMOUNT USES	COMMENTS	STRUCTURE TOTAL
46652.00000*2225	FISH CREEK MSF	W1379	4.00 CFS M	FISH CK-OUTLET LONG LK TO NO FK FISH CK	4.00
46652.00000*2234	GRANITE CREEK MSF	W1371	4.00 CFS M	GRANITE CK-HEAD WATERS TO FISH CK RES	4.00
46652.00000*2278	MIDDLE FORK FISH CK MSF	W1370	2.00 CFS M	MIDDLE FK of FISH CK-FISH CK RES TO NO FK FISH CK	2.00
46652.00000*2287	NORTH FK FISH CK MSF	W1368	5.00 CFS M	NORTH FK of FISH CK-CONF WITH MID FK FISH CK TO FISH CK	5.00
47189.00000 1348	FISH CREEK MSF LOWER	79CW104	2.00 CFS M	FISH CK-MT WERNER PL TO YAMPA R.	2.00
47189.00000*2544	FISH CREEK MSF	79CW104	9.00 CFS M	FISH CK-CONF NO FK TO MT WERNER PL	9.00
47832.00000 3508	FISH CREEK RES	80CW255	2000 AF 2	MIDDLE FK of FISH CK-(COND) DILIGENCE 85CW44, 89CW39	3842
48577.24616 2505	GOUMAZ DITCH	83CW38	2.00 CFS 19	LITTLE FISH CK	2.00
50007.00000 5042	BRISTOL WELL 3	87CW22	0.010 CFS 8	LITTLE FISH CK	0.010
50011.00000 4226	PHASE 3 RESERVOIR	86CW161	455.00 AF ALL	SOUTH FK of FISH CK-(COND)	763.10
50038.50007 1383	FISH CREEK SUBDIV SP 1	87CW21	0.021 CFS 8	LITTLE FISH CK-(COND)	0.021
50098.00000 1493	WILDLIFE WATER SPRING	87CW33	0.033 CFS 0	FISH CK	0.033
50769.44346 3596	LODWICK POND	89CW140	13.03 AF 156	FISH CK-AMENDED DECREE 89CW140	13.03
50769.50604 1616	LODWICK POND OUTLET D.	89CW127	2.00 CFS 1569	FISH CK	2.00
50769.50604*3599	VALENTINE POND	89CW127	1.82 AF 1569	FISH CK	1.82

March 18, 1992

#1950-3 (Fish Creek Reservoir Expansion)

Dear Sherry B. Reed, District Ranger:

I question the need for the expansion of the Fish Creek Reservoir or any of the alternative reservoir selection sites. I believe the City of Steamboat Springs and the County of Routt need to implement conservation techniques. I request that our water management planners and the forest service focus their attention from large supply-side projects such as dams and reservoirs toward demand-side projects including residential retrofit programs, irrigation efficiency programs and commercial and industrial reuse and efficiency programs.

The Rocky Mountain Institute(RMI), a Colorado nonprofit Corporation founded in 1982 by energy analysts Hunter and Amory Lovins sole purpose is to foster the efficient and sustainable use of resources as a path to global security. RMI interrelated programs deal with water and energy productivity, sustainable agriculture, redefining security, and local economic development.

The latest publications of RMI's water program are available today. The studies and model cities prove beyond a doubt that water conservation is the wave of the future and that in practice it works. In this day and age of hiring consultants for exorbitant amounts of money we as a community could spend a mear 15.00 to receive the latest information available on water efficiency programs their benefits and results.

This study was completed by the RMI;
WATER EFFICIENCY: A RESOURCE FOR UTILITY MANAGERS, COMMUNITY PLANNERS, AND OTHER DECISION MAKERS.

*Describes in detail the economics, technology, and implementation techniques of successful water efficiency programs.
*Highlights over 80 case studies from across the country.
*Includes an extensive contact list of individuals and organizations.
*114 pages, including tables and graphs.
$15-(pub.#W91-27)
1739 Snowmass Cr. Rd.
Snowmass, CO 81654-9199
(303) 927-3851

Some samples from the study:

HOTEL RETROFITS-The Lenox Hotel in Boston reduced its average water demand by about 40%(3.6 million gallons per year water savings and 15,000$ annual cost savings) by replacing conventional

plumbing fixtures in its 220 rooms with high efficiency fixtures. These savings have been achieved with no reduction in fixture performance or customer satisfaction and with no problems with waste water flow.

AGRICUTURAL TRANSFERS-Casper, Wyoming obtained 2,000 acre feet of water per year for municipal use in return for repairing and lining parts of local irrigation canal and lateral systems to reduce seepage.

REBATE PROGRAMS-In Mesa,Arizona, local officials developed a rebate program for landscape water efficiency improvements. As a result, some participants use 40% less water than their turf intensive neighbors.

This is just a small sampling of ideas I think we as a community need to implement. We have the opportunity today to be the model city of tomorrow and we're going to lose the chance if we're not careful. We need to think creatively.

"By installing a few simple water-saving devices costing less than $50.00 the average household can save more than 30,000 gallons of water each year." Amory Lovins Director of Research, RMI.

"According to Home Energy magazine, we would save over 250 million gallons of water every day if every American home installed faucet aerators. Intalling aerators on kitchen and bathrrom sink faucets will cut water use by as much as 280 gallons per month for a typical family of 4."

I believe the cost of increasing the Fish Creek Res. would far surpass the costs required to retrofit every home in Steamboat Springs. I believe the water we could save as a community would far outway the number of acre-feet we will gain with this expansion. Our building codes and requirements must advance technologically. We must implement water conservation all the way and create incentives and requirements for new and existing structures. We must stop wasting this precious resource. We must stop our laziness toward change. Drought is here to stay.

Sincerely,

MB Warner

MB Warner
PO Box 770335
Steamboat Springs, CO 80477
(303) 879-0350

CRE INVESTMENTS LTD.

C. Robert Enever
President

March 20, 1992

Members of City Council
City of Steamboat Springs

Members of the Board
Mt Werner Water and Sanitation District

Sherry Reed SBW
Hahn's Peak District Ranger

Subject: Fish Creek Reservoir Expansion

Fish Creek Mobile Home Park lies at the confluence of Fish Creek and the Yampa River, immediately downstream from the proposed enlargement of the Fish Creek Reservoir. The owners of the 65 homes located there will be concerned that the life and safety of approximately 200 year-round residents are taken into account in the planning for this project. As the owner of the Park I have taken it upon myself to represent their interests.

We understand that the engineers' job will be to create a design that will be reasonably safe, but we also know that events beyond our knowledge or control can happen: a design error, a construction error, a geologic condition, an earthquake or terrorism are among the things that could cause a sudden break in the dam.

1 We believe it should be economically feasible to construct a computer model "crisis analysis" that would approximate the shape of the Fish Creek valley and the adjacent areas of the Yampa valley, approximate the flow speed of the water modified by surface friction and produce a series of projected "status reports" at 5 minute intervals from the break. From this, those of us in the community concerned with the conflicting objectives of reasonable safety and reasonable cost could understand the nature of the problem and agree on a logical alarm system and evacuation plan.

It is possible that the study could be done for little cost if the Colorado School of Mines were to recruit their engineering and science students to update their study of 1990, reported in the Steamboat Pilot of May 17, 1990 (copy attached). A qualified engineer could revise the study for accuracy and reliability.

City Council, Mt Werner District and the Forest Service are urged to ensure that the crisis analysis is included in the project study and that enough information is made available for us to evaluate available alternative alarm and evacuation plans and the methods for ensuring they will always be in a state of readiness.

Bob

Wendy WS
Ken KK
File —

MAR 1992

Real Estate Investments
P.O. Box 239, Steamboat Springs, Colorado 80477
Telephone 303-879-2017
Message Machine 303-879-3719

Fish Creek dam's killer potential

The Steamboat Pilot
Steamboat Springs
Colorado
May 17, 1990

by JOANNA DODDER

While it is inspected annually and deemed structurally safe, the Fish Creek Dam and Reservoir poses more potential danger to Routt County lives than any other structure.

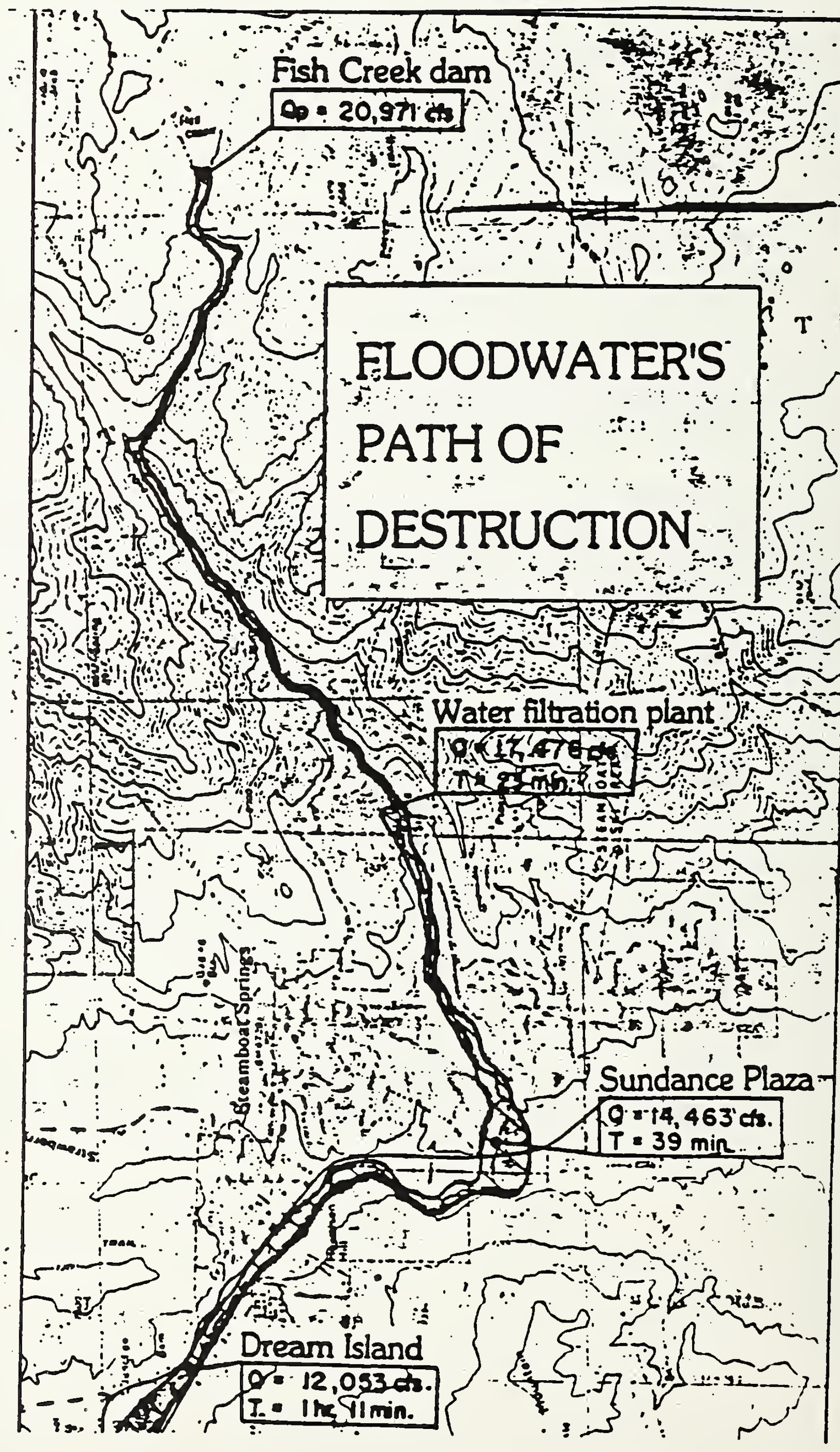
The reservoir's 1,800 acre-feet of water are held in check by a 36-year-old earthen dam directly above Steamboat Springs in the Routt National Forest at an elevation of 10,300 feet. For most of the year, the dam is inundated with 15-20 feet of snow and is inaccessible except by snowmobile or helicopter. A major source of drinking water, the dam is owned and operated by the City of Steamboat Springs.

If the dam were to break, no one would know until it hit the Fish Creek Filtration Plant 23 minutes later. Workers at that plant wouldn't be warning anyone downstream, however; they'd most likely be dead. Seventeen minutes later, according to Division of Water Resources estimates, more than 17,000 cubic feet of water would slam into the new senior citizens center, Sundance Plaza, and Fish Creek Mobile Home Park.

A thorough study of the impacts of such a catastrophe has never been calculated. Likewise, the city's emergency evacuation plan is sketchy and outdated at best. An emergency drill has never been conducted.

The most detailed analysis to date was just completed by a group of undergraduate students at the Colorado School of Mines in Golden for a year-end project. It was performed at the request of Mike Foth, Routt County emergency services coordinator.

The students concluded that at least 100 lives would be lost and tens of millions of dollars worth of property would be destroyed. This conclusion correlates with more general statements made by state government officials.



Students research ways to avoid disaster

If the dam were to fail, loss of life and significant damage to improved property is anticipated," concluded a state engineer in labeling the dam "high hazard."

"Because the loss of life would be so great if the dam should fail," the students recommended an early warning system, an updated evacuation plan and emergency drills, said student Robert Higgins when the group presented the plan to local officials earlier this month.

City officials later said they are seriously considering installing the recommended early warning system, as well as updating their emergency plan.

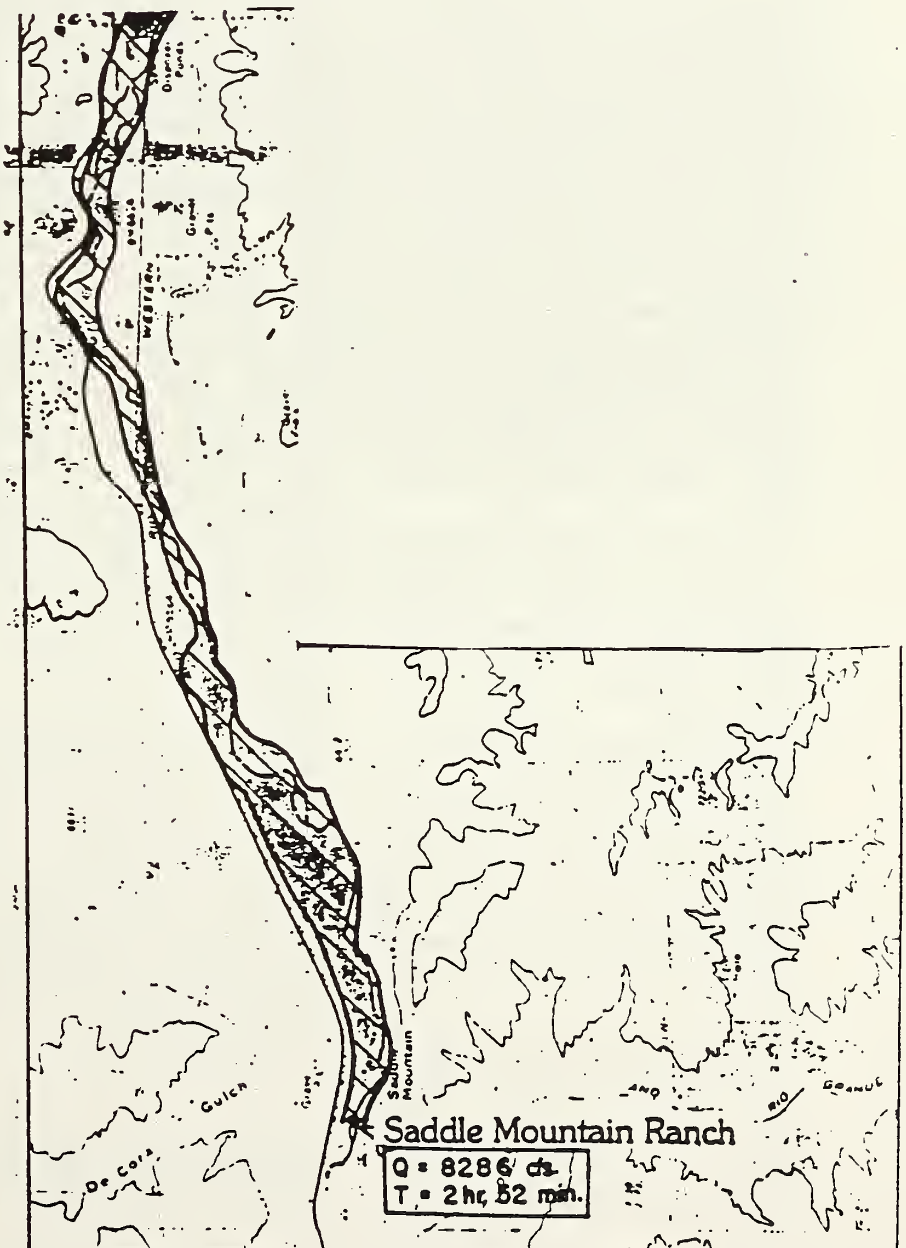
Although inexpensive versions of early warning systems can be installed for under $10,000, they are rare in Colorado, confirmed state officials. Not coincidentally, one of the few dams to get one will be the Olympic Dam near Estes Park. Residents of this mountain community are keenly aware of the fact that the impossible can occur. They were the victims of the 1982 Lawn Lake dam failure. The crumbling of the Sage Creek Dam spillway in Routt County was even more recent, although the results were much less severe.

In general, it seems that preparing for the impossible is often the last item on the "to-do" list for most communities around the country.

THE SCENARIO

The scientist and engineering students scouted the Steamboat area and compared it with information compiled by the Colorado Division of Water Resources and the U.S. Army Corps of Engineers in developing a flood scenario.

By the time the floodwaters began to exit the narrow Fish Creek canyon at the filtration plant three miles below the dam, the torrent would be close to four times the size of a 500-year flood, said the School of Mines study. A 500-year flood is a flood that is likely to occur only once every 500 years.



The first homes would be hit 12 minutes later a mile downstream. A half-dozen homes, the 12-unit Chaparral apartments, the new senior citizens housing, and the 60-unit Pine Grove Apartments would be hit.

Two dozen businesses in Sundance Plaza would also be flooded. While the topography widens, reducing the floodwater depth, the flow would still be 14,500 cubic feet per second, or about three times that of a 500-year flood. The time of day would be a major factor in the loss of life here.

"The greatest potential for loss of life exists at the confluence of Fish Creek and the Yampa River," says the study. About 65 mobile homes are home to about 150 people in the Fish Creek Trailer Park. The Fish Creek Campground is also nearby. Although the 14,000 cfs there would be well under the Yampa River's 20,000 cfs for a 500-year flood, conditions would be worse than indicated because the eastbound flood would change direction toward the north, creating high turbulence and water levels. The water would still be carrying a great deal of debris such as boulders, timbers, and pieces of buildings that had been destroyed upstream. Most of the trailer homes would be swept away.

As the waters hit the Brooklyn area 3/4 mile downstream, the topography narrows, creating deeper waters and more force. About a dozen houses and several small businesses would be in great danger.

Parts of downtown Steamboat would be flooded, but much would remain high and dry. Lincoln Avenue between Seventh and Ninth streets would be underwater, however, and Yampa Street would be under 10 feet of water. The city's fire and rescue vehicles are garaged along this street.

The next major concentration of people in danger would be in Dream Island Mobile Home Park, with about 70 mobile homes. It is entirely within the 100-year floodplain. Hills on either side of the river narrow the channel, which means the floodwaters would be deep enough to endanger the lives of residents there.

The last area to be affected would be the Riverside subdivision. About two dozen homes and trailers are in the floodplain here.

The study concluded that a flood at night would cause a greater loss of life.

WARNING DEVICES

Not only could an early warning device warn of an imminent flood, the students noted, but it also might be able to prevent a flood by warning the city before the dam breaks.

The students analyzed several early warning devices, keeping in mind Mike Loth's preference for a low-cost device.

They recommended a simple float switch device that uses a magnet in the float to actuate a sealed single-pole double-throw switch whenever the float changes position. This change in turn activates an Emergency Status Circuit to transmit the water level. It is reliable, requires low maintenance, requires minimal energy, and is not affected by temperature, the study determined. It costs only $750.

The students also recommended a "pressure transducer" to monitor the dam and tell if it is under stress. Since it must be located at the bottom of the dam, it would be cheaper to install it when the dam undergoes enlargement.

Since there is already a radio repeater station nearby, the students recommended that the information be relayed through radio data transmission. Components would include a model 5050 data transmitter with radio interface, a 12-volt type gel cell in conjunction with solar panels, and a central station consisting of an IBM computer and Data-Command software.

EVACUATION PLAN

Although the city's current evacuation plan meets minimum requirements as specified by law, "it would be inadequate to effect evacuation of the floodplain if a monitoring system gave advance warning of an approaching flood," the study concluded.

Sirens near Sundance Plaza and Dream Island would be a good idea, the students suggested, in conjunction with the existing siren downtown. Other systems such as radio and TV broadcasts and a telephone network system could also be used.

Rescue workers would likely be needed to help evacuate areas such as the senior citizens center. Since the Fish Creek Mobile Home Park only has one exit, police assistance would probably be needed to direct traffic. They recommended that the park manager work with local police to develop their own evacuation plan.

Drills could include sending police to Fish Creek Falls to confirm the oncoming flood, testing of the warning devices, and public meetings to inform residents of drill procedures.

The study also said it may be beneficial to discourage further floodplain development through planning procedures. Wisconsin, for example, has introduced legislation that limits insurance reimbursements for flood damage in the 100-year floodplain to one-half the amount required to repair or rebuild.

In conclusion, the students noted that the entire system could be installed for $5,000-10,000.

"Besides the safety of its own downstream residents, Steamboat Springs should consider its commitment to the safety of the thousands of visitors it hosts each year," added the students. "A disaster in which many people died would certainly tarnish the image of a town that is so dependent on tourism. The germane question is, 'Can we afford not to have this added measure of warning and safety?'"

Students involved in the study included Jim Bomba, Scott Davis, Todd Freeman, Robert Higgins, Todd Mushovic, and Adam Rompage. Other sources included the Bureau of Reclamation documents and local officials.

8040 Bellamah Ct. N.E.
Albuquerque, NM 87110
March 23, 1992

Sherry B. Reed, District Ranger
Hahns Peak Ranger District
P.O. Box 771212
Steamboat Springs, CO 80477

Dear Ms. Reed:

Please place my name on your mailing list to receive the Environmental Impact Statement for Fish Creek Reservoir Expansion, Routt National Forest.

Thank you.

Sincerely,

John Geddie

John Geddie

SBW
~~Ken~~ KK
Wendy WS
File —

MAR 1992

Wendy WJ
File

March 31, 1992

APR 1992

Sherry B. Reed, District Ranger
Hahn's Peak Ranger District
P.O.Box 1212
Steamboat Springs CO 80477

Re: Fish Creek Reservoir Proposal

Dear Sherry: SBR

As a community member advocating effiecient use of our recources, I am disturbed that officials are discussing increasing the size of our reservoir before aggressive pursuit of water efficiency options. Old-fashioned thinking is out of sinc with the times. Only engineers believe expensive infrastructure is superior to low-cost, rapid-payback, job-creating, environmentally-kind water efficiency measures.

1. Steamboat Springs needs to implement "Least-Cost Planning" like other model communities, whereby the cost of saving water through various water efficiency programs is compared to the costs of increasing water supplies. Other communities have found that $1 spent on water efficiency improvements yields the same amount of water as $3 spent on new supplies (dams, etc.). Community water efficiency includes: water efficient plumbing fixtures and shower-heads (with no less enjoyable showers), low-flush toilets (with no less effective toilet flushes), water efficient lawn watering equipment including drip irrigation, and xeriscape planting methods.

In Goleta, California, instead of bringing in more needed water supplies for the district's 74,000 people, they installed 17,000 ultra low-flush toilets and 35,000 high-performance showerheads. Through rate structures, water metering and public awareness programs they encouraged the installation of water efficient fixtures and the use of efficient outdoor watering methods. Within one year the per capita residential water use fell by 50% and total use fell by 30%. With later savings, total use fell by 40%. This efficiency program cost Goleta $1.5 million -- they exceeded their water savings goals and reduced sewage flow by over one-third, eliminating an expensive expansion of their wastewater treatment plant. For more details see <u>Water Efficiency</u> (page 6) by Rocky Mountain Institute.

2. Water-Meter based billing <u>must</u> be in place, and its effects on usage documented for at least two years before any discussion of building a new dam. The current flat-rate water billing encourages consumption and discourages the efficient use of water. A baseline must be established where people pay for the amount of water they use.

3. A "Whole-Systems Approach" must be taken when considering any new increases in water supply. What are the present and future effects of an increase in water supply on:

a) water treatment plants and capacities?
b) treated water storage capacity?
c) water distribution systems and capacities?
d) waste water collection systems and capacities?
e) waste water treatment plants and capacities?

The investigation of new water supplies is only a part of the total impact upon the community. With more available water in the future, we will also be paying for its additional treatment, storage, distribution, waste water collection and treatment. Your EIS should describe the cumulative effects of doubling our reservoir size and how much each will cost.

4. The Rocky Mountain Institute, an independent, non-partisan, non-profit, resource policy center, research and educational foundation located in Old Snowmass, Colorado has made Water one of its five study areas. I am including as a addendum to my letter copies of several of their publications:

a) Water Efficiency (a major resource to help communities save water)
b) The Water Program at Rocky Mountain Institute
c) Water Efficiency for Your Home

5. Are the local taxpayers being asked to pay for more water because we really need it, or because the Sheraton golf course would "look better" for tourists during the summer?

Let's not get the cart before the horse. We need to consider the large effect of inexpensive water efficiency <u>before</u> we consider expensive and environmentally harmful additions to our water supply.

Thank you for this opportunity to comment on the proposal. I will be participating this spring in a meeting with several Steamboat Springs city council members to discuss the efficient use of water in our community. They have also been provided with copies of the above publications to review before that time. If you are interested, I would also like you to attend that meeting. I will let you know of the date and time.

Sincerely,

Mark H. Palmer

Mark H. Palmer

THE WATER PROGRAM AT ROCKY MOUNTAIN INSTITUTE

June 1989 - Jim Dyer, Director

Introduction

Many nations, regions, and communities suffer from inefficient use of water resources. Some areas are physically short of water, or at least of uncontaminated water; some pay too much to pump it; and many face enormous capital costs for increased water-storing capacity against drought or wastewater treatment capacity to reduce pollution -- costs claimed to be unavoidable, but in fact strongly dependent on the amount of water used.

Yet both water shortages and related costs can often be eliminated by increasing water productivity -- wringing more work from each drop, through advanced technologies that use water more efficiently in every sector. A virtual galaxy of new water-saving hardware, ways to analyze its potential, and ways to finance and deliver it now offer a practical alternative to traditional supply expansions, at greatly reduced cost and risk.

Rocky Mountain Institute's Water Program is an effort to assemble and deliver these tools for water efficiency to those who need them -- and to package those tools into a form they can apply easily, promptly, and effectively.

Water policy today is strikingly analogous to energy policy in the early 1970s. It emphasizes increased supply, of the highest possible quality (whether needed for the task or not), at the largest possible scale (even if that introduces serious diseconomies), at practically any cost in both money and environmental harm. It conventionally denies the existence of alternatives, claiming that savings are possible only by curtailing lifestyles and sacrificing services, not by technical improvements in efficiency. Pursuing this mistaken strategy crippled much of the energy industry: firms built more and costlier capacity than could be amortized from revenues. Many flagship energy projects simply collapsed, victims of an incurable attack of market forces, thereby wasting both billions of dollars and years of even more precious time.

There are important differences between energy and water -- chiefly in laws and institutions which enforce economically inefficient water-using behavior -- but also valuable parallels. Rocky Mountain Institute is applying the lessons learned in energy policy to improving water productivity by developing tools which will permit water providers, local governments, householders, farmers, ranchers, and industrial firms to save large amounts of water at very low cost. Implementing these technologies and delivery techniques can sustain our nation's abundant water supply, cut the cost of water to end-users, reduce the need for wastewater treatment, protect the environment, and create wealth.

[illegible] ROAD SNOWMASS COLORADO [illegible]
[illegible]

Taking these new factors into account -- and, where possible, other environmental costs and benefits -- *WASH* will enable a policymaker to estimate how much it is worth paying to save a given amount of water under local conditions.

Stage Two: Technologies for saving water

The next step in the *WASH* process provides a complete and detailed catalog of advanced hardware for saving water -- its nature, applicability, availability, cost, performance, and field experience. This catalog is described more fully below, and is analogous to RMI's database on electricity-saving devices. The residential/light-commercial hardware catalog was published in early 1988 and is attracting widespread and enthusiastic use. A 1989 Second Edition is in preparation, reflecting rapid expansion of the hardware market. Planning and research are now under way also for an analogous catalog for the agricultural sector -- among the Water Program's main priorities for 1989.

Stage Three: "Supply curves" of potential water savings

A third section of *WASH* will estimate how much water of various qualities is used for different tasks, and will then combine this end-use structure with the hardware data to yield supply curves of cost-effective potential savings, relating their quantity to their marginal cost. RMI has long applied this technique to detailed analysis of potential energy savings. Preliminary applications to water savings have proven illuminating.

Stage Four: Implementation options

The final element of *WASH* will collate the rapidly growing body of practical knowledge on how to translate that theoretical savings potential into actual field installations. This section will provide state-of-the-art data about

- who is saving how much water, how fast, at what cost, by what means;
- how to structure model codes and other regulatory instruments (including urban-scale mass retrofits, which are now being tested);
- how innovative financing methods which RMI developed for electric utilities can be translated for water institutions; and
- how to overcome legal and institutional barriers.

Collection of this information is well underway; some has already been used in a report requested by Colorado Governor Roy Romer. In June 1989, RMI accelerated its data collection by sponsoring a conference at which leading practitioners of water efficiency pooled their experience of what works.

PAT DAVEY
P.O. Box 772278
Steamboat Spr. CO
80477

COMMENT SHEET

COMMENTS
Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

1 I would like to see that all possible reservoir sites are given equal opportunity for development or enlargement. (Wren, Nash).

The enlargement of the reservoir will mainly benefit the Mt. Werner Water District. The city engineer says that the present water supply could last for 10 yrs if water efficiency was promoted.

2 If Mt Werner District is out of water, they should be paying for the enlargement. Currently, Mt. Werner Dist. users pay $32/qua. for water & sewer. The city users pay $114/qrt. The Mt. Werner users have been free loading for 20 yrs, it's time for them to pay their fare share. Also, the Werner Dist has had water meters installed for at least ten years and are not charged by their useage but by a flat rate. It's time the users are held accountable for their use of one of most precious natural resources we have around Steamboat; Water.

3 Finally, I would like to see Mt. Werner Water & Sanitation District be disolved. The Werner District is located 100% within the the city limits. It is may understanding that the city has the authority to dissolve Mt. Werner as of today. Having two government entities is very inefficient.

Would you like to be on this project mailing list? yes no
Name and address (Please Print):

(See Above)

APR 1992

Wendy WS

File

COMMENT SHEET

COMMENTS
Please provide your thoughts and comments below. It is important that you provide us with rationale behind your concerns so that we may explore all issues to the fullest.

1 The city of Steamboat Springs has the water presently in hand and under its control that is truly needed for the buildout of the existing City.
2 Present residents should not be obligated to provide for and pay for unwanted and environmentally damaging development. Such development
3 necessarily occurs at the expense of our diminishing open space, at
4 the expense of our once free-flowing streams, and adding pollution
5 to our already overburdened once clean air.

Already the ballooning property tax burden on the longtime residents is forcing some to abandon what is rightfully their heritage here. The project has the familiar odor of a scheme to take money out of a lot of pockets and put it in the pockets of a favored "visionary" few.

6 Despite an expensive early warning system, nothing is perfect... neither the dam, the heightened dam, nor the early warning system. The Fish Creek drainage and all its residents, The new Sanctuary, all of the Fairway Meadows residents, and the entire town below Fish Creek drainage will have an "at risk" factor multiplied many fold if the dam is raised, due to the elevation of the site and the steep drainage below the dam. Even if you luck out and get an early warning....what good is it if everything comes down the valley an hour later? An elevated dam greatly increases the total jeopardy. It aint broke. Let's don't fix it.

~~Sherry~~
Wendy WS
File

Would you like to be on this project mailing list? yes no
Name and address (Please Print):

Gene Cook
41025 RCR 36
Steamboat Springs CO 80487

APR 1992

JMH ASSOCIATES, INC.

April 2, 1992

SRW

Sherry Reed, District Ranger
Hahns Peak District
U. S. Forest Service
P. O. Box 771212
Steamboat Springs, CO 80477

Re: Expansion of Fish Creek Reservoir

Dear Ms. Reed:

Steamboat Springs has been my home for the last 20 years. During this time I have become completely aware of the fundamental significance of water and water storage to our literal survival in the western United States. The expansion of Fish Creek Reservoir is both necessary and a refreshing example of the farsighted planning of the Mt. Werner Water Board. They are planning for our future with guarantees of water necessary for the inhabitants of this valley to continue living here without the fear of loss or curtailment of this basic necessity.

This project needs your complete and total support. This is a project having virtually no impact on the environment since it's an expansion of an existing dam impacting only five acres of
1 wetlands which will be replaced threefold. The long term benefits of increased water storage allowing maintenance of the fishery and water for domestic use are priceless commodities.

Environmental impacts are practically nonexistent and the advantages of increased water storage are so obvious the approval of this project should be without question. I understand government guidelines must be followed prior to the project actually being approved, and those guidelines will include some limited environmental studies. Since the major impact has already occurred with the original construction of the dam, any major
2 environmental impact study would not only be a waste of time but an egregious waste of the public's money.

Wendy WS
File —

APR 1992

P.O. BOX 881360 – STEAMBOAT SPRINGS, COLORADO 80488 – (303) 879-3311

Sherry Reed
April 2, 1992
Page Two

I am in complete and full support of this project and encourage you to move forward as expeditiously as possible with the approval of this project. Should you have any questions, please do not hesitate to call me.

Sincerely,

J. Mark Halvorson

J. Mark Halvorson

JMH/dl
cc: Mt. Werner Water & Sanitation District

JOHN R. ADAMS
ONE TABOR CENTER, SUITE 2500
1200 SEVENTEENTH STREET
DENVER, COLORADO 80202
(303) 623-8317

Wendy WS
File —

April 2, 1992

Sherry B. Reed, District Ranger
Hahns Peak Ranger District
P O Box 1212
Steamboat Springs, CO 80477

Re: Fish Creek Reservoir Proposal

Dear Ms. Reed: SBR

I have recently been given some general information about the proposal for the Fish Creek Reservoir as jointly presented by the City of Steamboat Springs and the Mt. Werner Water and Sanitation District. I am sorry that I was unable to attend the scoping meeting on March 18, 1992 but I was out of town at that time. I wanted to express my support for the proposal as currently made by the above referenced parties.

Planning for the future, in my judgment, is an important component of my support for this proposal. Because of the lead time from the initial phases until completion of construction of a project of this nature, I believe that it is essential that this project go forward at this time. From the information that I have received it is apparent to me that the Mt. Werner Water and Sanitation District, as well as the City of Steamboat Springs, will be in need of additional domestic water supply within the next five to ten years.

The project as proposed, which would result in an enlargement of an existing impoundment, seems attractive to me over the various alternatives in the neighboring area that are under study. I believe that minimal disturbance of the environment and a maximization of recreational values would be accomplished by approval of the Fish Creek Reservoir site. Enlargement of this reservoir appears to me to be one of the most efficient methods of maintaining the necessary reserves. I would guess that the costs of the other alternatives would be greater on a per acre foot basis.

I am firmly in favor of the proposed plan and would offer further input when appropriate.

Sincerely,

John R Adams

John R. Adams

APR 1992

JRA/dl/nks

cc: Mr. Don Valentine
Mt. Werner Water and Sanitation District

ref: 1950.3

Arianthe Stettner
P.O. Box 880220
Steamboat Springs, CO 80488
April 3, 1992

SBR

Sherry B. Reed, District Ranger
Hahn's Peak Ranger District
P.O. Box 1212
Steamboat Springs, CO 80477

Wendy WS
File

APR 1992

Dear Sherry,

My thanks to you and the Forest Service for allowing the chance to share my concerns about the proposed expansion of the Fish Creek Reservoir through the EIS process.

I see this proposal as an opportunity to solve a perceived problem through a change in thinking and action. Traditional approaches to water resource needs have been to construct dams and store more water. But there are other ways to achieve what the proponents say is their need:adequate water supplies for the residents of Steamboat Springs in the future, without negative environmental impacts.

The economy of nature is a good model, or doing more with less. Through better allocation and greater efficiency existing water resources can supply residents with their needs for many years into the future at far less cost, no environmental impacts to Forest Service lands, and creating new jobs and businesses in the process. I suggest the following points to address in the EIS:

1. 1. Consolidate the Mount Werner District with the City of Steamboat to eliminate inefficiencies in administration, disparate water rates to residents, and eliminate the problem of no water storage rights for the District. This town does not need to support two water bureaucracies.

2.

2. Begin meter-based water billing NOW to encourage resource conservation by all water users in the city. No volume-based discounts!

3. Encourage use of the new water conservation fixtures in existing homes and rental units. Require their use in all new construction. These fixtures include low flow showerheads, faucet aerators, and low flush toilets, to name a few.

4. Allow the use of grey water for lawn and garden needs by changing existing building codes to accomodate additional plumbing requirements.

5. Replace the aging and inadequate City water pipes to minimize water loss through leaks and breakage.

3 Additionally, I am concerned that existing residents may have to underwrite the cost of this project through higher taxes, a bond issue, and so forth while it is future residents and developers who will recieve the main benefits.

4 And at the root of all these thougnts is the question: how large an urban area does Steamboat Springs wish to become? When? Steamboat Springs is made up of its citizens who can articulate their views through the EIS process and other dialogues. I DO NOT want to see this community become a Grand Junction sized population center. Increasing water storage capacity is another step in building the infrastructure to support more people. Next comes a bigger sewer plant, ad infinitum.

So, there are some of my concerns at this time. Please keep me informed as this evolves.

MATTLAGE, LETTUNICH & VANDERBLOEMEN
ATTORNEYS AT LAW
ALPINE SAVINGS BUILDING
200 LINCOLN AVENUE, SUITE 300
P. O. BOX 773990
STEAMBOAT SPRINGS, COLORADO 80477

KARL P. MATTLAGE
ANTHONY B. LETTUNICH
JOHN A. VANDERBLOEMEN

TELEPHONE
(303) 879-0100
TELECOPIER
(303) 870-0960

April 7, 1992

Ms. Sherry Reed SRM
Hahns Peak District Ranger
P.O. Box 771212
Steamboat Springs, CO 80477

RE: Expansion of the Fish Creek Reservoir

Dear Ms. Reed:

I just wanted to send you this letter to express my support for the proposed expansion to the Fish Creek Reservoir. I do not represent any party in this matter, but am merely sending this letter of support as a citizen concerned with the preservation of water rights in this area.

Very truly yours,

Anthony B. Lettunich

Anthony B. Lettunich

ABL/bo

Wendy WS
File –

APR 1992

Emmett K. Olson
P. O. BOX 774303 • 1719 HIGHLAND WAY
STEAMBOAT SPRINGS, COLORADO 80477

April 9, 1992

MS SHERRY REED SBR
HAHNS PEAK DISTRICT RANGER
U.S. FOREST SERVICE
P.O. BOX 1212
STEAMBOAT SPRINGS, CO. 80477

DEAR MS REED,

WE RECENTLY RETURNED FROM A THREE MONTH TRIP OUT OF THE COUNTRY. IN READING MY MAIL, I SEE WHERE A COMMUNITY SURVEY HAD BEEN MADE OF STEAMBOAT PEOPLE--RESIDENT OR NON-RESIDENT.

ONE OF THE SUBJECTS OF THIS SURVEY WAS ASKING OUR OPINION REGARDING THE ENLARGEMENT OF THE FISH CREEK RESERVOIR. I UNDERSTAND THAT YOUR OFFICE IS ALSO INTERESTED IN PUBLIC OPINION ON THIS MATTER.

I BELIEVE THAT THE ENLARGEMENT OF FISH CREEK RESERVOIR IS A WISE MOVE FOR LONG RANGE PLANNING OF OUR WATER RESOURCES. WE ALL MUST REALIZE HOW VITAL WATER IS TO ALL US NOW AND IN YEARS TO COME. PLEASE ACCEPT MY ENDORSEMENT AND ENCOURAGEMENT FOR THIS PROJECT.

SINCERELY,

E K Olson

Wendy WS
File

APR 1992

A MEMBER OF THE SEARS FINANCIAL NETWORK

COLDWELL BANKER

SILVER OAK, LTD.

200 LINCOLN AVENUE
P.O. BOX 5023
STEAMBOAT SPRINGS, CO 80477
BUS (303) 879-8814
FAX (303) 879-0390

April 9, 1992 SAR

Sherry Reed
U.S. Forest Service
P.O. Box 771212
Steamboat Springs, CO 80477

Dear Ms. Reed:

This is to advise you that I am very much in support of the expansion of the Fish Creek Reservoir. Water and water storage is only going to become more critical, not just to Routt County, but to the whole State of Colorado in the years to come. This project is very necessary to insure our valley that we will have enough water for our needs, both now and in the future.

I will appreciate any information that you send out, be sent to me as well. I am a native Coloradan and have resided in Routt County for 25 years.

Thank you for your attention in this matter.

Sincerely,

Mix Beauvais

Mix Beauvais, GRI
Owner/Associate

Wendy WS
File —

April 10, 1992

Ms Sherry ~~Reed~~ SBR
Routt National Forest
Steamboat Springs, Colo 80487

APR 1992

Dear Ms Reed -

I am very much in support of the Fish Creek Reservior enlargement.

We need to conserve all the water we can for our use and for Colorado. It is important to have it on line and functional for our growing needs, both recreational and industry.

Sincerely
Robert G. Moss
Willow Creek Ranch
Clark, Colo 80428

Wendy WS
File

[illegible]

City of Steamboat Springs

April 14, 1992

APR 1992

Sherry Reed
District Ranger
Box 771212
Steamboat Springs, CO 80477

Dear Ms. Reed:

On May 18, 1992, I had occasion to attend a meeting conducted by your office for the purpose of preparing a Scoping Statement and ultimately a Scoping Document with respect to the City's application for a Special Use Permit so that it can expand the Fish Creek Falls Reservoir.

At the May 18 meeting, a number of individuals made statements suggesting that the Forest Service consider a denial of the proposed expansion and thereby discourage growth within the Routt County area. At this point I had anticipated that your representative would restrict comments to those addressing environmental and ecological concerns and remind the audience that growth and planning issues are issues reserved by the State Constitution to cities and counties and beyond the scope of the National Environmental Protection Act. When this failed to occur, I became concerned and made a decision to write to you.

I strongly believe that the integrity of your Scoping meetings is at risk if you fail to educate the public regarding the purpose of these meetings or continue to permit comments that are not relevant to the very difficult and complex issues with which you are entrusted arising out of the potential environmental and ecological impacts of a proposed development. In the future, I hope you will allow both myself, other City Council members and the Routt County Commissioners to assist you whenever growth and development issues are raised.

I am willing to meet with you on these and any other matters at your convenience.

Very truly yours,

Paula Cap Black

Paula Black
President Pro Tem
Steamboat Springs City Council

P.O. Box 775088, Steamboat Springs, Colorado 80477
City Hall - 879-2060; Utility Accounting - 879-6993; Police - 879-1144; Public Works Shop - 879-1807
Steamboat Springs Airport - 879-9042; Transit - 879-5585; FAX: 303-879-8851

KLAUZER & TREMAINE
Attorneys at Law
P O BOX 774525, STEAMBOAT SPRINGS, COLORADO 80477
525 Lincoln Avenue

Randall W. Klauzer
Member Colorado Bar

J. Richard Tremaine
Member Colorado, D.C. and Virginia Bars

Phone (303) 879-5003
Fax (303) 879-1131

April 30, 1992

MAY 1992

SBR KK

Sherry B. ~~Reed~~, District Ranger
Hahns Peak Ranger District
P.O. Box 1212
Steamboat Springs, CO 80477-1212

Dear Sherry:

This letter is being sent to you on behalf of the Board of Directors of the Fish Creek Meadows Association in Steamboat Springs, Colorado.

With the enlargement of the Fish Creek Reservoir under consideration, the Board is concerned about the potential for flooding in our area should there be a dam failure. Our subdivision (Fish Creek Meadows) lies directly north of Fish Creek and overlooks that valley. While we are currently well above the flood plain for Fish Creek, we believe it is imperative that your evaluation of this reservoir enlargement answer the questions:

> In case of a disastrous dam failure, would the flood waters reach our homes, how much warning would there be, and what would be the nearest high ground for Fish Creek Meadows residents?

Thank you for considering these concerns of our neighborhood.

Sincerely,

Richard Tremaine

Richard Tremaine, President
Fish Creek Meadows Association

JRT/jt

Wendy WS
File

Sherry SBR
Wendy WS

John O. Ross
P.O. Box 1766
Steamboat Springs, CO 80477

May 5, 1992

Mary Brown, President
Steamboat Springs City Council
P.O. Box 775088
Steamboat Springs, CO 80477

Dear Mary,

In connection with the proposed expansion of the Fish Creek Reservoir, I would like to request several items. In making this request I am representing myself as a property owner and resident in the City of Steamboat Springs, and not representing any group or organization. The items requested are:

1. Copy of the City Council Resolution authorizing the application to the U.S. Forest Service for this expansion.
2. Copy of the Ordinance authorizing expenditure by the City of Steamboat Springs for the Environmental Impact Statement.
3. Copy of the Steamboat Springs Planning Commission authorization for this expansion per CRS 31-23-209 (Copy enclosed)
4. Copy of the Agreement between the Mt. Werner Water and Sanitation District and the City of Steamboat Springs regarding this expansion.

Thank you for furnishing these items.

Yours Truly,

John O. Ross

c.c. Richard Tremaine
U.S. Forest Service, Hahn's Peak Ranger District

5/6/92

Sherry Reed, District Ranger

Dear Sherry, It's my understanding that at least some of these things have not been done by the City of Steamboat Springs. It's also my understanding that the U.S. Forest Service can't approve projects which [illegible] non-legal actions by governmental bodies.

John O. Ross
P.O. Box 1766
Steamboat Springs, CO 80477

May 5, 1992

SBR

Sherry Reed
District Ranger
Hahn's Peak Ranger District
P.O. Box 771212
Steamboat Springs, CO 80477

Dear Sherry,

As with all or maybe most cold water fishery rivers in Colorado, the Yampa River has a classification for use and purity. As a result, it's ability to maintain itself in that classification limits the biological oxygen demand (BOD) that it can sustain. When considering the proposed Fish Creek Reservoir expansion, with the additional water placing additional BOD requirements on the river, the capacity of the Yampa River to absorb this added BOD must be considered in my opinion. Also, the additional waste treatment facility costs to protect the Yampa should be determined and made public.

I would appreciate very much knowing that your EIS review of this proposed project will include a review of the complete environmental effect and cost of both the proposed enlargement and other associated potential costs such as this.

Yours Truly,

John Ross

John O. Ross

Wendy WS

APPENDIX B

ID TEAM MEETING MINUTES

1.0 INTRODUCTION

The initial Fish Creek Reservoir Expansion Environmental Impact Statement (EIS) ID Team meeting was held at the Routt National Forest Supervisor's office at 9:00 am on May 29, 1992. The following were in attendance:

Name	Organization
Wendy Schmitzer	Forest Service (FS) - ID Team Leader
Jean Ray	ACZ - Assistant Project Manager
Ken Kowynia	FS - Lands
Kirk Wolff	FS - Soils/Hydrology
Mike Retzlaff	FS - Planning/Economics
Sue Struthers	FS - Cultural Resources
Loren Labovitch	FS - Volunteer
Kim Vogel	FS - Public Affairs
Julie McQuary	FS - Visuals/Aesthetics
Neil Siettmann	FS - Engineering/Safety
Kit Buell	FS - Wildlife/Fisheries
Trish Clabaugh	FS - Social Concerns
Leo Snowden	FS - Transportation
Conrad Parrish	ACZ - Project Manager
Sherry Reed	FS - District Ranger
Dan Birch	City of Steamboat Springs
Rob Schmitzer	FS - Recreation/Wilderness
Jerry Schmidt	FS - Forest Supervisor

Rob Schmitzer and Jerry Schmidt were only able to attend the final portion of the session. The meeting agenda is attached.

Wendy Schmitzer and Conrad Parrish moderated the meeting discussions. The meeting began with the introduction of participants, a discussion of meeting objectives and the description of the roles of the key project team members. Wendy discussed the third party agreement between the Forest Service, ACZ Inc. (ACZ) and the project proponent. The Fish Creek Reservoir expansion proponent is a partnership between the City of Steamboat Springs (City) and the Mt. Werner Water and Sanitation District (Mt. Werner).

Kim Vogel expressed concern that City and ACZ representatives were present at the ID team meeting. Wendy responded that ACZ was present to assist in facilitating the meeting process. She noted that the City was present to act as a technical resource and to observe and further understand the National Environmental Policy Act (NEPA) process.

2.0 PROJECT BACKGROUND

Dan Birch presented a slide presentation summarizing the project history. The present reservoir covers 90 acres and has a capacity of 1800 acre-feet (ac-ft). The proposed expansion would inundate an additional 50 acres and provide an additional 2200 ac-ft of storage capacity. The proposed reservoir, therefore, would have a total capacity of 4000 ac-ft and cover an area of 140 acres. Dan also discussed several alternative reservoir sites considered by the City and Mt. Werner, including the Wren, Nash, and Long Lake sites.

Dan responded to several questions on water system operations and water rights. While the City maintains direct flow and storage rights, Mt. Werner has only direct flow water rights. In general, the City system operates as follows: Between April and August (approximately), the City utilizes its direct flow rights from Fish Creek. In August (approximately), the City begins releasing an additional 2 cubic feet per second (cfs) from storage (the total flow being released is approximately 6-8 cfs). Between August and October, the water level in the reservoir gradually decreases. In October, the City cuts back on released flow, and the reservoir once again begins to fill. The City maintains good flow records and has gaging stations on two influent streams, the spillway, and the outlet.

The City also maintains an infiltration gallery alluvial groundwater system. According to Dan, the alluvial wells serve two primary purposes:

- Provide water to the system during peak demands

- Provide redundancy to the water distribution system

Since there is only one line from the Fish Creek Filtration Plant into the City system, the wells provide the assurance that water can be moved into the system from an additional source. While the alluvial groundwater wells provide several benefits to the City, Dan feels that they should not be utilized as a primary water source since the water is of lesser quality than the Fish Creek supply and since the water must be pumped into the system. System operational costs could increase substantially if continued pumping is required.

Mt. Werner presently maintains direct flow rights from Fish Creek. They also supplement their supply with water from infiltration gallery wells. Presently, water taken from Fish Creek is treated at the Fish Creek Filtration Plant for both the City's and Mt. Werner's water systems. Additionally, well water for both water systems is pumped through a common pump station. With the construction of the proposed dam, the City may turn over up to 2000 ac-ft of conditional water rights to Mt. Werner.

3.0 ISSUES

After the review of the project background and the subsequent discussions pertaining to water system operations, the ID Team examined the summary of public comments. Additional issues, Forest Service management concerns, and potential connected actions were discussed. It was determined that all identified issues would have to address direct, indirect, and cumulative effects. For that reason, cumulative effects were eliminated as an issue.

After all issues had been identified and discussed, the ID Team determined whether the issues were significant or insignificant. Wendy and Conrad reviewed the definition of significance and noted that all issues would be discussed regardless of the determination of their significance status. Rather, it was noted that all significant issues must be addressed in the identification and analysis of alternatives.

Following is a brief description of the issues identified by the public and the ID Team.

3.1 Significant Issues

3.1.1 Dam Safety and Flood Hazard

- Dam safety cannot be guaranteed
- Portions of Steamboat are at risk of flooding
- Warning systems will not prevent dam failure
- There is currently the need for an evacuation plan
- Improvements in dam safety (including an early warning system) may result from dam expansion
- Area geology will impact flood boundaries
- Location of fault zone may indicate potential dam failure
- Area property and homes may be destroyed by flooding; what recourse does an individual have?
- What are the costs (monetary and non-monetary) of dam failure?
- Permit terms must be included to protect public lands and insure that the costs resulting from potential dam failure are borne by the proponent

Issue Statement: This issue addresses dam safety, including dam design and construction criteria, an early warning system, and an evacuation plan. It includes monetary and non-monetary costs associated with potential dam failure and subsequent flooding.

3.1.2 Cost

- Financing - how will the project be funded and paid for?
- Economic efficiency - what are the overall costs and benefits (on a local, regional, federal level)?
- Equity - who is paying and who is benefitting from the project?
- With low interest rates, money is cheap at this point in time
- What are the impacts to fixed-income residents?
- What are the cumulative costs through the system (including water treatment and distribution and wastewater collection and treatment)?

Issue Statement: This issue addresses the cost, financing, economic efficiency, and the equity of the proposed dam expansion. It includes cumulative costs through the system.

3.1.3 Need for the Project

- What is the City's need?
- What is Mt. Werner's need?
- What is the timing of the need?
- How does potential service area expansion correspond to the projected need?
- How does need relate to moderate income housing?
- How does the projected expansion capacity (2,200 ac-ft) correspond to the projected need?
- What percentage of this need could be offset by consolidation (jurisdictional and/or functional) of the City's and Mt. Werner's water districts?
- What percentage of this need could be offset by environmental education and conservation programs?

- Would expansion be required if the City and Mt. Werner shared resources and instituted conservation measures?

Issue Statement: This issue concerns the purpose and need for the dam expansion for the City and for Mt. Werner, considering individual and combined resources. It includes the timing of the need in light of potential consolidation of water districts and conservation programs.

3.1.4 Wetlands

- Concern exists for possible wetlands loss and the impact on threatened and endangered species
- With expansion, there exists the opportunity to enhance wetlands and wildlife habitat
- Reclamation of borrow sources must ensue if borrow sources are wetlands
- 404 and 401 permits must be obtained
- Reclamation of wetlands should address aesthetic concerns

Issue Statement: This issue considers the potential loss of wetlands and includes concerns associated with the loss of habitat, threatened and endangered species, permitting, reclamation, and aesthetics.

3.1.5 Fisheries

- Habitat improvement may not be needed
- Habitat improvement may be positive
- What is the cost resulting from the temporary loss of fisheries?
- What is the difference between the natural channel/flow regime, the existing regime, and the proposed regime?
- What are the impacts of water system operations on the fisheries?
- What are the effects of in stream flows on fisheries?
- The proposed expansion must meet all standards and guidelines for fisheries.
- Is a fishery an appropriate use for a watershed?
- How does in stream flow impact channel maintenance?

Issue Statement: This issue is directed at impacts to fisheries in terms of cost, various channel/flow regimes, water system operations, and regulations and guidelines.

3.1.6 Consequential Growth Impacts

- What is the cause and effect relationship between growth and water storage?
- Does water storage promote growth and result in changes in lifestyle and the quality of life?
- By limiting water supply, are we limiting growth and development?
- Does limiting water storage raise the cost of living?
- By limiting water supply, are we limiting low income housing within and outside of City limits?

Issue Statement: This issue addresses the consequential growth impacts of the proposed reservoir expansion and includes potential changes in area growth patterns and development and impacts to individual and community lifestyle and quality of life.

3.2 Insignificant Issues

3.2.1. Water Quantity/Quality

- What are the impacts of the proposed expansion on water rights?
- What are the direct and indirect impacts on water quality?
- What is the impact of sedimentation during construction activities on turbidity and total suspended solids?
- How does the recreational usage of the reservoir impact water quality?
- Will the expansion result in increased recreational usage and increased water quality impacts?

3.2.2 Recreation

- How will the proposed expansion impact the dispersed campground at the reservoir?
- Is camping an acceptable use at a municipal water supply?

3.2.3 Transportation

- What are the impacts to the roads from construction equipment?
- What are the long term impacts to the road system due to utilization of the area, assuming present level and increased utilization?
- Will the proponent assume a commensurate share of the costs associated with maintenance and repair of the roads?
- What is the proponents operating plan, during and after construction activities?
- Will the operating plan be incorporated into the permit?
- What mix of traffic will be utilizing the roads?

3.2.4 Wildlife

- What are the impacts to wildlife?
- Are any threatened and/or endangered species impacted?

3.2.5 Additional Forest Service Comments

- Adjust visual quality objectives (VQO) and incorporate visual mitigation into design; where possible, improve visual aspects of a project, including structures, parking areas, roads, staging areas, etc.
- If possible, use a borrow source outside of wetland areas
- Include construction safety (including fuel tank safety procedures) in the permit
- Conduct cultural surveys (level 2 surveys) on all viable alternatives
- Discuss connected actions, including the future development plans of the Buffalo Pass area

4.0 ALTERNATIVES

After the discussion of issues was completed, the ID Team identified a number of alternatives to be considered in the EIS:

- No Action
- Water Conservation
- Consolidation (jurisdictional/functional) of the City and Mt. Werner's water districts
- Expansion of well fields (City's and/or Mt. Werner's)
- Fish Creek Reservoir Expansion
- Nash Reservoir Construction
- Wren Reservoir Construction
- Long Lake Reservoir Expansion
- Construction of other (out of basin) reservoir sites (i.e. Walton Creek)
- Expansion of mainstream Yampa reservoir sites (i.e. Yamcola, Stagecoach, Catamount)
- Modified version (smaller/larger) of Fish Creek Reservoir Expansion
- Deepen Fish Creek Reservoir
- Combinations of above alternatives
- Alternative timing/phasing of facilities (or alternatives)

APPENDIX C

WATER CONSERVATION

Prepared for

United States Forest Service
Routt National Forest
29587 West U.S. 40, Suite 20
Steamboat Springs, Colorado 80487

WATER CONSERVATION

January 1993

Prepared by

ACZ Inc.
1475 Pine Grove Road, Suite 109
P.O. Box 774018
Steamboat Springs, Colorado 80477

TABLE OF CONTENTS

ACZ Inc. * P.O. Box 774018 * Steamboat Springs, Colorado 80477 * (303) 879-6260

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1.0 INTRODUCTION

In arid regions, such as the western United States, water has become an increasingly finite natural resource. Due to rapid growth and development, demand for water has steadily risen and has surpassed available supplies in some areas. Water resource management has traditionally been applied to the construction of treatment facilities and the development of water supply projects such as dams and reservoirs. However, because water resources have become scarce in many regions of the country, it has become necessary for water resource managers to develop water conservation techniques. Water conservation research has led to improvements in such water-using technologies as toilets, showerheads, irrigation equipment, and faucets. The development of more water-efficient appliances, as well as innovative management strategies, has enabled consumers to maintain the quality of their lifestyles while consuming less water. Due to these new developments, water efficiency has emerged as a viable alternative to developing new water supplies and expanding treatment facilities. The purpose of this study is to discuss some of the more efficient water-using measures that are now available and to present practical methods of promoting water conservation.

According to the United States Water Resources Council, water conservation can be defined as activities designed to (1) reduce the demand for water, (2) improve efficiency in use and reduce losses and waste of water, or (3) improve land management practices to conserve water (Maddaus, 1987). Through the installation of appropriate low flow water fixtures and by educating the public about techniques designed to reduce water use, water efficiency can be increased.

Water conservation programs can result in significant benefits to the water utility and its customers. In general, conservation measures can reduce demand or increase supply during drought years, or can extend short supplies during other emergency conditions. Water conservation can also result in:

- Energy savings
- Wastewater reductions
- Environmental protection
- Cost reductions

Reductions in water use can decrease the amount of energy used to heat water in homes and offices. Water heaters are the second largest energy users in the home, and heating water consumes the equivalent of 1.1 million barrels of oil per day nationwide. One third of our hot-water use can be reduced, however, by effective water conservation (Maddaus, 1987).

Water conservation is also a means by which costs associated with water and wastewater treatment can be lowered. Conserving water can decrease water demand and wastewater flow and thus save pumping energy and reduce chemical use involved in water and wastewater operations. Large water savings can also prevent the need to expand or build additional treatment facilities. Furthermore, as a means of protecting the environment, water use reductions may increase stream flows and water levels in existing reservoirs, and may reduce drawdown of underground aquifers (Maddaus, 1987).

Potential drawbacks that should be considered, however, prior to implementing a water conservation program include:

- Reduction of water utility revenues
- Growth inducement
- Increase in drought vulnerability due to the delay in construction of additional water supplies

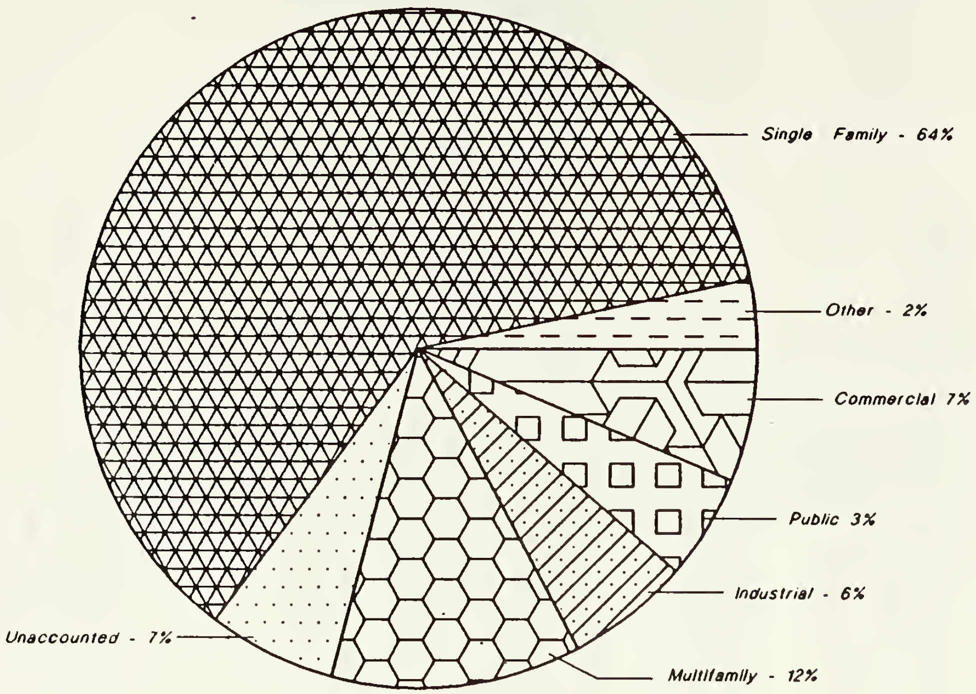
Because customers that practice water conservation and reduce their water use will have lower water bills, increased water-use efficiency can potentially reduce utility revenues. If a conservation program is cost-effective to the water utility, less revenue should be required to cover lower operating expenses. For this reason, advanced planning is necessary to determine the effect of conservation-related reductions on future demands and future revenues that will result from anticipated growth (Maddaus, 1987).

Due to demand reductions associated with water conservation programs, it is also possible that increased water efficiency will reduce the perceived need for additional water sources and thus postpone construction of additional water supply facilities. Delaying construction of new water supplies will mean that if substantial need arises in the future, the cost of supplying additional water will be higher. Furthermore, delaying the augmentation of a water utility's supply capacity may increase a community's vulnerability to drought and thus create more hardship during shortages. It will be difficult for communities that already practice methods of conservation and are without a major surplus of water to cut back on water use during times of drought. Again, this brings about the need for skillful advanced planning. In some cases, implementing conservation programs and constructing water supply projects at the same time may be the best course of action (Maddaus, 1987).

Finally, it is important to consider potential growth impacts. Water conservation can be perceived as creating additional sources of water which can be used to extend service to undeveloped areas. On the other hand, a lack of water can drive the cost of living up and potentially restrict growth in severe situations. In regions where community growth is controversial, these issues may be a problem (Maddaus, 1987).

Good planning is necessary to determine direct and indirect effects, and to weigh the costs and benefits of implementing effective water conservation. Decisions must also be made about the types of water use upon which a conservation program will focus. Figure 1, Typical Municipal Water Use, presents an average breakdown of municipal water demand nationwide and thus shows where the largest demand reductions are possible.

Presently, the issues surrounding water management are being compounded by federal and state environmental and public health regulations. Furthermore, because water, for the most part, is appropriated, the water problems of the next 100 years will likely consist of increased social and legal conflicts (Vranesh, 1989). In resolving these issues, it will be essential to promote effective water management and efficient water use through a conscious effort on the part of both the consumers and the suppliers of our nation's water resources.



TYPICAL MUNICIPAL WATER USE

SOURCE: Maddaus, 1987

Project No.: 828-1500	Design By: R. PETERSON	Scale: NO SCALE	FISH CREEK EIS
File: PIE1	Drawn By: T. CLARK	Date: DEC. 1992	
ACZ inc ENGINEERING AND ENVIRONMENTAL SERVICES STEAMBOAT SPRINGS, CO 80477	FIGURE 1		TYPICAL WATER USE

2.0 METHODS OF CONSERVATION

Table 1, Typical Long-Term Water Conservation Measures, presents an overview of conservation practices which can be used to reduce various types of water demand. The following section of this report discusses many of these methods and presents some typical demand reductions that have been achieved using these methods. Table 2, Typical Demand Reductions, summarizes these findings. The conservation methods addressed in this report are categorized in the following manner:

- Utility-Based Programs (management-oriented practices)
- Outdoor Water Use (irrigational and landscaping needs)
- Indoor Water Use (toilets, showers, sinks, etc.)
- Other Methods of Implementing Conservation (public education, regulatory measures)

2.1 UTILITY-BASED PROGRAMS

2.1.1 Metering/Rate Structuring

Meter based billing, in which customers are billed for water service based on metered water use, provides a strong incentive for customers to use less water than they would if he billed on a flat-rate or uniform-rate basis. Declining block rates, which allow larger water users to obtain lower unit prices than smaller water users, and flat rates have been used extensively in the past. Today, however, water utilities have found that the use of meters and rate structures which encourage the wise use of water are effective means of encouraging water conservation. Typically, water prices are determined according to the revenue needed to cover costs of adequate service to a utility's customer. Figure 2, Common Rate Structures, provides a graphic illustration of different types of rate structures. Two rate structures which typically result in water savings, the inclining block and peak/seasonal demand rate structures, are discussed below.

Inclining Block Rates

An inclining block rate (also referred to as an increasing block rate) is a price structure in which the unit price of water increases with use. This type of pricing has immediate effects on water use as consumers are inclined to save water in order to save money. The increasing block structure is especially effective in the summer when water use is high and the associated marginal price would be higher. For residential customers in Denver, Colorado reductions in use have approached 10 percent using this price structure (CDM, 1992). Some utilities use billing programs which combine flat rate-service charges with an inclining block rate structure.

Peak Demand Pricing/Seasonal Demand Pricing

Both peak and seasonal demand pricing are rate structures in which water utilities charge a higher price-per-volume of water during peak demand periods. The use of this type of rate structure tends to augment water savings during times when the largest demand reductions are possible. As is typical in most areas, the peak water demand period in Steamboat Springs occurs during the summer. Peak monthly usage is generally three times that of low monthly usage in

TABLE 1

TYPICAL LONG-TERM WATER CONSERVATION MEASURES

General	Public information
	In-school education
	Metering
	Pressure reduction
	Pricing
	    Uniform commodity rates
	    Inclining commodity rates
	    Seasonal rates
	Leak detection and repair
	System rehabilitation

Interior residential use	Low-flow shower heads Shower-flow restrictors Toilet–tank displacement bottles/dams Pipe insulation Faucet aerators Water-efficient appliances
Devices for new construction	Low-flush toilets and ultra-low-flow toilets Low-flush shower heads Pipe insulation Faucet aerators Water-efficient appliances
Power generation	*Recirculation of cooling water Reuse of treated wastewater *In-system treatment
Industrial use	*Recirculation of cooling water *Reuse of cooling and process water Reuse of treated waste water Efficient Landscape irrigation Low-Water-using fixtures *Process modification

Agricultural irrigation	Off-farm conveyance systems
	    *Canal lining, canal realignment, canal consolidation
	    *Phreatophyte control
	On-farm distribution and irrigation systems
	    *Ditch lining or piping
	    *Water-control structures
	    *Land leveling or contouring
	    Sprinkler irrigation
	    Drip irrigation
	    Subsurface irrigation
	    *Tailwater irrigation
	    Irrigation scheduling
	    *Improved tillage practices
	    Surface mulches
	    Pressure regulator

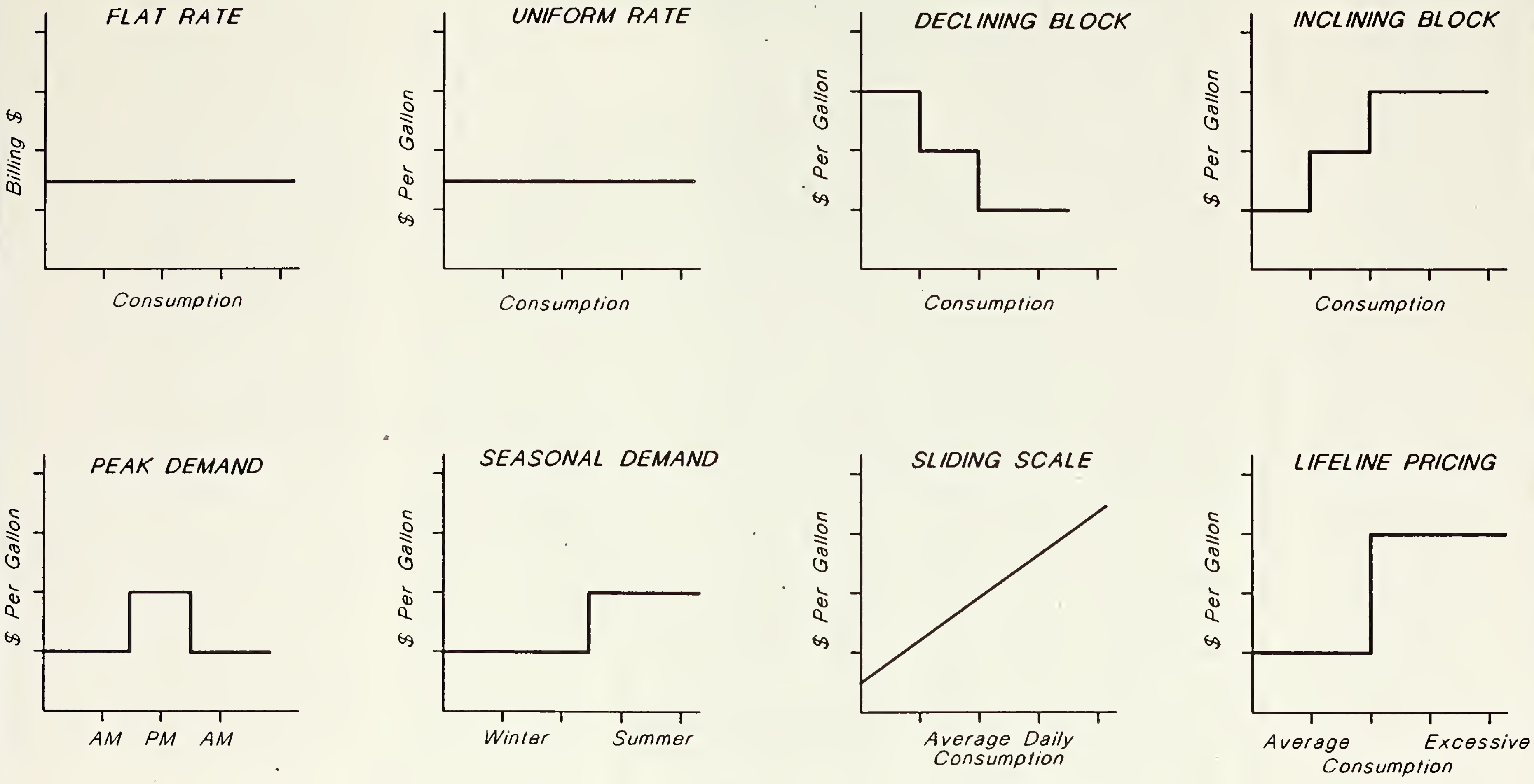
Landscape irrigation	Efficient landscape design Low-water-use plant material Scheduled irrigation Efficient irrigation systems Tensiometers

*These conservation practices are not discussed in detail in this report.

TABLE 2

TYPICAL DEMAND REDUCTIONS

Conservation Practices	Typical Reductions
Inclining Block Rates	10% of Residential Water Use
Peak/Seasonal Demand Pricing	6-83% of Peak Demand 3-10% of Total Demand
Pressure Reducing Valves (PRV's)	10% of Total Supply
General Outdoor Conservation	40-54% of Outdoor Use
Ultra Low Flow Toilets	57-78% of "Toilet Demand"
Low Flow Showerheads	34-50% of "Shower Demand"
Faucet Aerators	Up to 48% of "Faucet Demand"
Retrofit Kits sent to homes (toilet tank bag, leak detector, dye tablets, shower flow restrictors, rain gauges)	Up to 6% of Indoor Use
Public Education	8% of Total Water Use



SOURCE: U.S.G.S. 1992

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ACZ inc ENGINEERING AND ENVIRONMENTAL SERVICES STEAMBOAT SPRINGS, CO 80477	FIGURE 2		COMMON RATE STRUCTURES

Steamboat (ACZ, 1992). Because increased water demand during the summer is generally driven by landscaping and general irrigation needs (especially in arid regions such as Colorado), peak demand and/or seasonal demand rates often result in lower water usage for landscaping. Through peak demand pricing, reductions of 6 to 83 percent in peak demand and 3 to 10 percent in total demand have been reported (CDM, 1992).

2.1.2 Pressure Reduction/Leak Detection Programs

Pressure reducing valves (PRVs) are frequently installed on water mains or laterals in order to regulate flow pressure. For maximum efficiency, flow pressure should be between 50 and 60 pounds per square inch (psi) (RMI, 1991). Installing PRVs during the construction of new water systems is always the least costly way to regulate water pressure. Generally, installing PRVs in existing lines provides insignificant gains, but in large areas where pressure exceeds 60 to 80 psi, retrofitting with PRVs on some main lines may be cost effective (RMI, 1991). Maintaining efficient flow pressures within a water system can provide immediate and long-term benefits to both the community and individual consumers and is especially important to the success of low flow plumbing fixtures. Pressure reduction programs implemented by the Denver Water Department have resulted in savings of up to 10 percent (CDM, 1992).

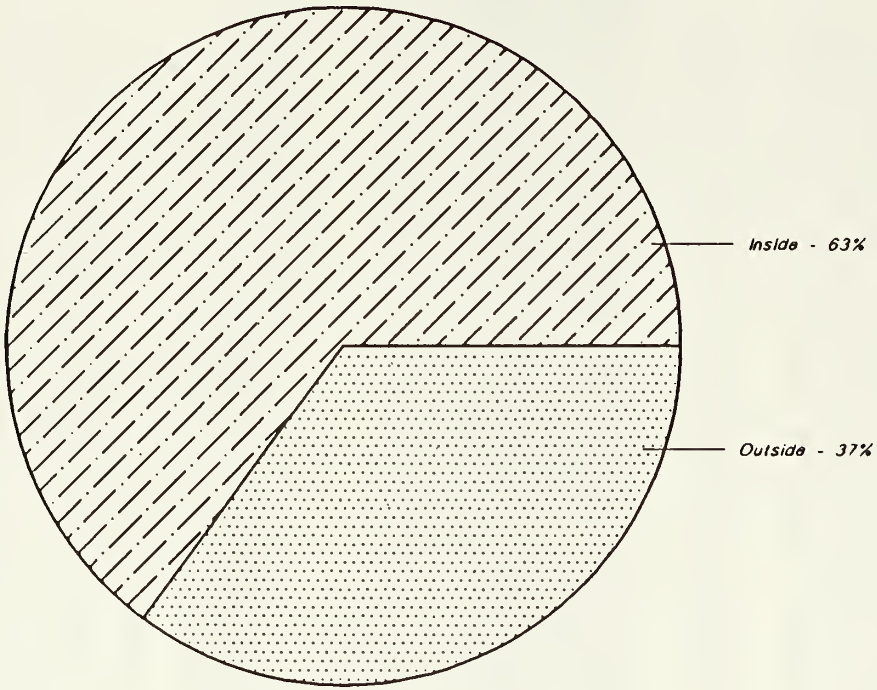
The detection and repair of leaks in utility water distribution systems can also result in significant water savings. Unaccounted for water use has been reported to be as high as 25 to 35 percent (Conserv, 1990), but it is generally estimated in the range of 8 to 15 percent of the total water supplied to a system (CDM, 1992). In Boston, Massachusetts leak detection programs reduced the amount of water lost in the system from a high of 50 percent in 1976 to 36 percent in 1982 (Maddaus, 1987). More recently, the City of Glenwood Springs, Colorado has conducted a leak detection survey which resulted in savings of approximately 331,000 gallons of water per day (ACZ, 1992).

2.2 OUTDOOR WATER USE

As shown in Figure 3, Residential Water Use, nearly 40 percent of residential water demand is comprised of outdoor water use. However, during the summer, outdoor water use in arid and semi-arid regions can comprise over 70 percent of a household's water needs (Danielson, Feldhake, and Hart, 1981). Because of the addition of outdoor water needs, annual water demands typically peak during the summer. For this reason, conservation programs often focus on the summer season and target outdoor water use such as watering lawns, washing cars, and irrigating crops.

The majority of outdoor water usage is due to agricultural and landscaping needs. Because a large portion of the water used for irrigation (whether it be for agriculture or for landscaping) is lost to evapotranspiration and is not returned to the watershed, it is important to irrigate efficiently in order to reduce water waste. Efficient irrigation techniques can be promoted through public education, rate structuring, incentive programs, and in some cases regulatory measures. Through implementation of outdoor conservation programs, savings of 40 to 54 percent on individual lots have been reported (CDM, 1992). Today, the most efficient methods of horticultural-based conservation include:

- Evapotranspiration programs
- Drip or trickle irrigation
- Automated watering



Residential Water Use

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ACZ inc ENGINEERING AND ENVIRONMENTAL SERVICES STEAMBOAT SPRINGS, CO 80477	FIGURE 3		TYPICAL WATER USE

SOURCE: Maddaus, 1987

- Soil moisture monitors
- Cycle irrigation
- Xeriscaping

2.2.1 Evapotranspiration Programs

Evapotranspiration (ET) is the amount of water lost to evaporation and transpiration (water consumption) by plants. Based on temperature, precipitation, solar radiation, humidity, and plant or turf (lawn) type, an ET value can be estimated that quantifies the exact amount of water needed to maintain healthy vegetation. ET ratings inform consumers of how much water they need to apply to their lawns, thereby minimizing water waste. In conjunction with ET ratings, consumers are typically restricted to watering on specified days, which also tends to decrease water use.

2.2.2 Drip or Trickle Irrigation

Due to low evaporation rates and direct application, drip irrigation and subsurface trickle irrigation for non-turf (lawn) areas are two very efficient methods of applying water to agricultural crops and to residential, commercial, or industrial landscapes. Both of these methods have proven to be as effective as using sprinklers but a great deal more efficient. Deep drip irrigation can also reduce weeding requirements by making it more difficult for weeds to sprout in surface soil. It can also flush salts below the root zone increasing the quality of the near surface soils.

2.2.3 Automated Watering

A timed sprinkler system can increase efficiency by monitoring how long and at what time water is applied to a lawn. By shifting lawn watering patterns to the evenings or early mornings when evaporation rates are lower, less water is required.

2.2.4 Soil Moisture Monitors

Buried electronic sensors, such as gypsum block tensiometers, are able to monitor soil moisture and determine when the soil is dry and needs watering. The buried block absorbs and loses moisture at approximately the same rate as the surrounding soil, and can thus advise consumers of how much water is needed to keep the soil moist. These monitors can be used in conjunction with drip or trickle irrigation or automated watering systems to increase efficiency even more. The use of soil moisture monitors has reportedly resulted in up to 50 percent reductions in irrigational water use (RMI, 1991).

2.2.5 Cycle Irrigation

The concept of cycle irrigation involves the application of water in cycles according to the time it takes for significant runoff to occur. The purpose of applying water in cycles is to reduce runoff (essentially wasted water) by allowing each cycle of water to be absorbed into the soil before applying the next allotment. By reducing runoff, water waste is held to a minimum and watering becomes more efficient. This method of conservation is especially effective on small turf areas found in typical single family homes.

2.2.6 Xeriscaping

Xeriscaping may be the most effective method of reducing irrigation water demand. Essentially, xeriscaping entails landscaping with indigenous, low-water demand plants. These types of plants are referred to as xerophytes. In this manner, landscaping can provide functional and aesthetic value without requiring large quantities of water. In general, the fundamentals of xeriscaping include:

- Limiting turf (lawn) areas which generally require large quantities of water
- Irrigating efficiently (using methods such as those aforementioned)
- Improving the soil for better absorption of water and improved water-holding capacity
- Using mulches in planting beds to minimize evaporation, reduce weed growth, and slow erosion
- Using native, lower water demanding plants and turfs (xerophytes)
- Performing appropriate maintenance frequently

Even in the absence of turf reductions, the implementation of xeriscaping techniques has resulted in an average savings of 23 percent of a consumer's outdoor water use (Maddaus, 1987). However, studies that have been done on xeriscaping have shown that landscapes with half as much turf as traditional yards require 54 percent less water, 25 percent less labor, 61 percent less fertilizer, 22 percent less herbicide, and 44 percent less fuel to maintain (RMI, 1991).

Xeriscaping is also being recognized as an umbrella concept that can provide solutions to other resource management problems. Besides reducing demand on water supplies, xeriscaping can also:

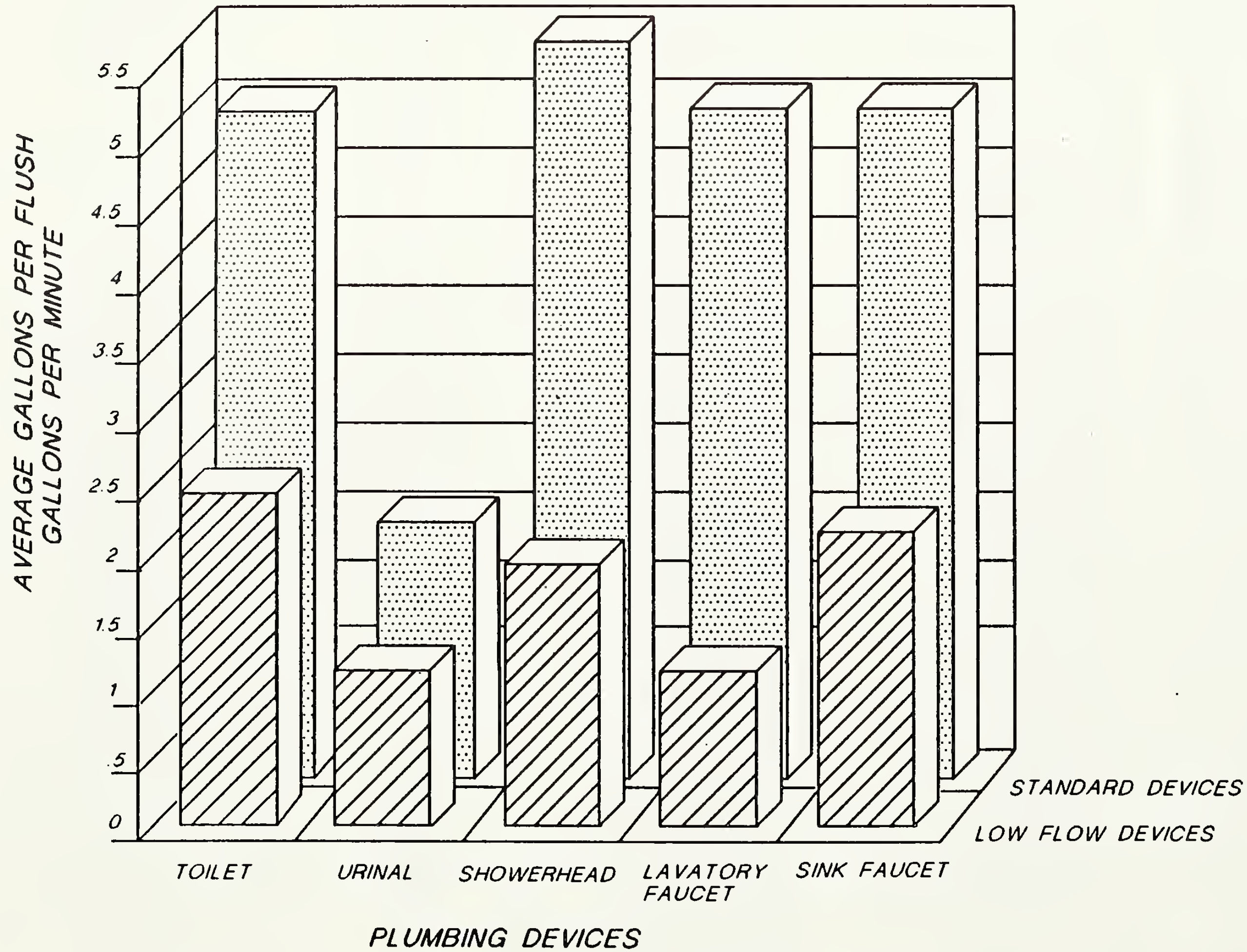
- Preserve and enhance water quality by reducing non-point source water pollution (less fertilizer)
- Reduce demands for non-renewable energy resources (lowers energy consumption of water and wastewater treatment facilities)
- Reduce solid waste disposal (no grass clippings)
- Beautify sometimes harsh urban environments (using native plants)
- Preserve local biological diversity

Non-point source pollution occurs from surface water discharges and accounts for approximately 80 percent of the nitrogen and 50 percent of the phosphorous contamination of the nation's rivers and streams (Conserv, 1990). Reducing fertilizer applications for native landscapes will decrease this type of pollution.

2.3 INDOOR WATER USE

2.3.1 Low Flow Devices

The installation of low flow faucets has long been recognized as a quick and simple way to reduce water demand. The utilization of these products is achieved through building ordinances that require the installation of low flow plumbing devices and through retrofit programs that replace traditional plumbing devices with low flow devices. Figure 4, Comparison of Standard and Low Flow Plumbing Devices shows the contrast between average flow rates of standard and



Based on 60 PSI
Source: RMI, 1991

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ACZ inc ENGINEERING AND ENVIRONMENTAL SERVICES STEAMBOAT SPRINGS, CO 80477		FIGURE 4	COMPARISON OF STANDARD AND LOW FLOW PLUMBING DEVICES

low flow fixtures. Low flow fixtures generally use about half of the water that traditional devices use.

Plumbing fixtures which contribute to residential indoor water demand are shown in Figure 5, Residential Indoor Water Use. As the figure shows, almost 90 percent of water consumption in common households is associated with flushing the toilet, taking a shower, washing clothes, or running the sink. With low flow devices, it is possible to reduce the flow rates of all four of these items.

Toilets

Traditional toilets use between 5 and 7 gallons of water per flush (gpf). Low flow and ultra low flow toilets, however, use only 3.5 and 1.6 gpf respectively (RMI, 1991). Low flow toilets are currently being manufactured and used all over the world including Mexico, South America, Asia, Europe, Australia, Indonesia, Sweden, and the United States (Conserv, 1990). Replacing a conventional toilet with an ultra low flow toilet can reportedly result in savings of 57 to 78 percent in this category of plumbing fixtures (RMI, 1991).

Another method of reducing a toilet's flow rate is the use of damming or displacement devices. Volume displacements with bottles or bricks, or tank displacement kits, are an inexpensive means of reducing water use in toilets without replacement costs. There are, however, several drawbacks with using these devices. Some devices do not fit properly in all toilet models and some may reduce toilet flush performance. Furthermore, the savings that have been reported with use of toilet dams is relatively low (less than 10 percent) compared to what can be saved with a toilet replacement (RMI, 1991). Dual flush systems, a retrofit device which allows users to vary the flush volume of a toilet, may be the most effective yet inexpensive method of retrofitting high-water demand toilets.

Showerheads

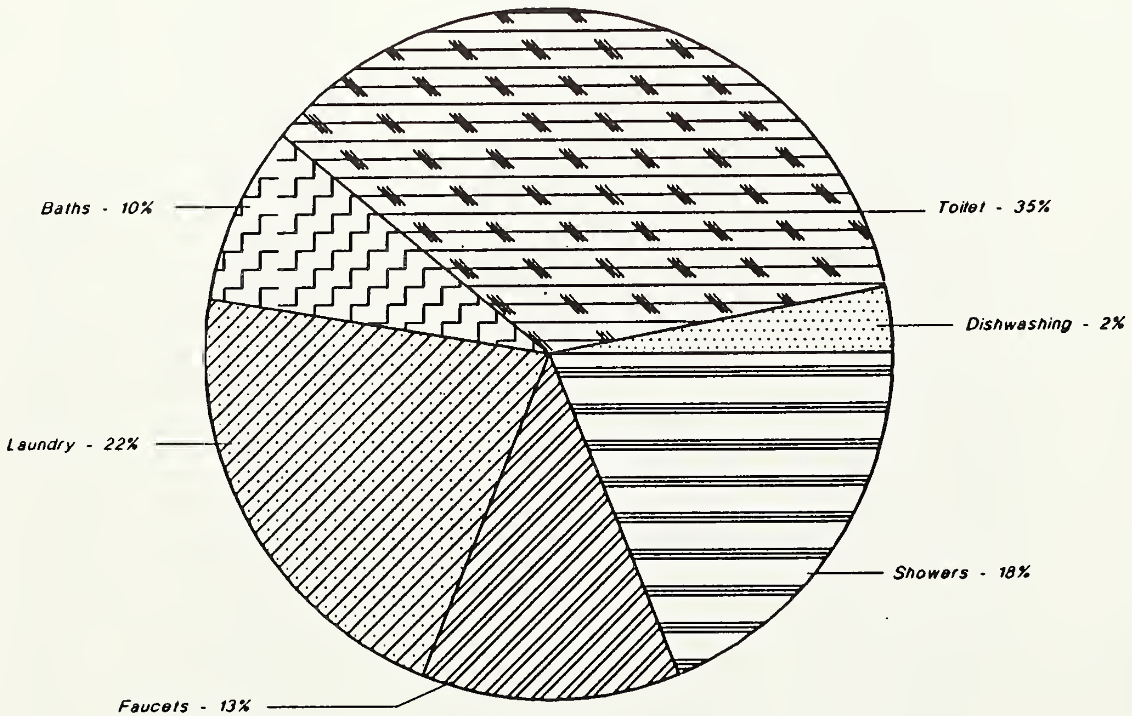
Conventional showerheads typically use between 4 and 8 gallons of water per minute (gpm). Low flow showerheads use no more than 2.5 gpm, yet maintain the same service quality of higher-flow models (RMI, 1991). By replacing one conventional showerhead with a low flow model, water demand can be reduced by 34 to 50 percent in this category (RMI, 1991).

Faucet Aerators

Efficient faucet aerators are inexpensive and easy to install, and can reduce demand in this category by up to 48 percent (RMI, 1991).

Washing Machines

Front-loading washing machines, which tumble clothes on a horizontal axis using a lower volume of water, typically use 40 percent less water than top loading machines which submerge clothes in a tub full of water and agitate them on a vertical axis (RMI, 1991). Additionally, washing machines equipped with suds saver options and/or water level indicators can save 20 to 26 percent of the water normally used without these devices (CDM, 1992).



Residential Indoor Water Use

SOURCE: Maddaus, 1987

Project No.: 828-1500	Design By: R. PETERSON	Scale: NO SCALE
File: PIES	Drawn By: T. CLARK	Date: DEC. 1992

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FIGURE 5

FISH CREEK EIS

TYPICAL WATER USE

Initial installation of low flow devices in new housing or business developments tends to be the most cost effective way of implementing the use of low flow fixtures. However, retrofit programs can also be quite successful. The City of Aurora, Colorado has implemented a water conservation retrofit program in which kits (which include toilet tank bags, leak detector dye tablets, shower flow restrictors, and a rain gauge to improve lawn watering efficiency) were sent out to homes built prior to 1977. Savings of up to 6 percent of indoor water use have resulted from this program (CDM, 1992).

2.3.2 Leak Detection

Leak detection surveys done on household water systems are referred to as home water audits. A leaky toilet can waste an average of 750 gallons of water per month and a leaky faucet up to 300 gallons per month (RMI, 1991). This indicates that reducing leaky plumbing can greatly reduce water waste. Another option for conducting water audits is to distribute leak detection kits and allow consumers to detect and repair leaks themselves.

In colder regions of the country, water loss often occurs from water faucets being run continuously in the winter to prevent freezing. Freezing can be prevented, however, by simply insulating water lines and/or crawl-space, and by using thermostatic heat tape.

2.4 OTHER METHODS OF IMPLEMENTING CONSERVATION

2.4.1 Public Education

Since most consumers give little thought to their water use habits except during times of shortage, public education can teach consumers about water conservation techniques and provide a basis for the development of conservation ethics. Consumers must first be made aware of water waste and then learn ways to reduce this waste. Generally, public education programs are strengthened when the need to conserve is high, but benefits associated with teaching people about water efficiency will likely have long-term impacts also. Making full use of education, communication, and media opportunities is important for a successful public education program. School programs, workshops, ET announcements, newspaper feature articles, brochures, and demonstrations are some of the most common programs.

A public education program conducted by a Southern California water district spent 1.3 million dollars on paid advertising to urge customers to conserve water. Their efforts resulted in an 8 percent reduction in total water use (CWA, 1989).

2.4.2 Regulatory Measures

The option to develop and enforce conservation-based water regulations is one which allows municipalities to achieve immediate and long-term results in reducing water demand. It has become increasingly common to modify building and plumbing codes to require low flow devices, mandatory landscaping restrictions, and/or water meters in new developments. Because retrofitting homes and offices with water efficient devices can be time consuming and expensive, it is cost effective to install these devices during initial construction. To encourage retrofitting where needed, however, tax incentives modeled after energy tax credits can be used.

City ordinances can also be used to control water waste. Typically, these ordinances target superfluous water use in city streets, alleyways, and public places, and they often place

restrictions on washing cars and/or watering lawns. As with the implementation of building ordinances, the most successful water regulation programs are enforced. Generally, fines are imposed for non-compliance of ordinance requirements.

Another method that has proven to be effective during droughts (or in regions where water is scarce) is the use of zoning ordinances to restrict development according to the availability of water. Ordinances such as these often require developers to provide sufficient water rights or cash, in lieu of water rights, sufficient to acquire water supplies prior to the approval of the project. Developers must show that they have ample water to adequately service the expected water demand of the proposed project. In some cases, growth has been confined to the service capacity of a municipality's water utility. In Marin County, California, community growth was halted (no further tap permits were issued) when the service capacity of the local water supply was reached (CDM, 1992). It is important to note that this type of policy can increase the cost of living in restricted communities and can also promote growth in surrounding communities.

2.4.3 Water Recycling

Water recycling has been recognized by many as an effective means of conserving water and as a viable alternative to new water supplies. Increased development costs for new water supplies and advances in wastewater treatment capabilities have generated increased interest in water recycling. Typically, water is reused for non-potable purposes. The Denver Water Department, however, has demonstrated that the technology exists to treat wastewater to a potable (drinkable) quality (CDM, 1992).

At this time, effluent from wastewater treatment facilities is generally treated to secondary or tertiary standards. Secondary treatment removes about 90 percent of the biological oxygen demand and the suspended solids in the water, while tertiary treatment goes beyond secondary treatment and removes nutrients such as nitrogen and phosphorous and most of the suspended solids. Water that is treated to either of these standards can be used for a variety of applications, including surface or underground water recharge. The percolation or injection of wastewater into ground water aquifers is known as indirect recycling, and is commonly practiced in many parts of the United States, including California, Florida, and Arizona (CDM, 1992).

Direct use of reclaimed water is most commonly used for landscaping and for large turf area irrigation. The city of Tucson, Arizona uses reclaimed water exclusively to irrigate the city's golf courses (RMI, 1991). Large applications of recycled water such as this can significantly reduce demands on potable water supplies and, in the case of secondary-treated effluent, add valuable nutrients such as nitrates and phosphates to the soil (which in turn reduces demand for costly chemical fertilizers). It is important to note, however, that the use of secondary-treated effluent for irrigational purposes can contribute to non-point source pollution of water supplies.

Direct use of reclaimed water also occurs for industrial and some residential purposes. Gray water is the effluent from bathtubs, showers, bathroom sinks, washing machines, and the non-greasy water from kitchen sinks. Although the use of gray water is not recommended for all applications, it can be filtered and used for irrigational purposes. Home recycling systems in which gray water is categorized and stored for use to flush toilets has been implemented in Windhoek, South Africa, in the Grand Canyon, Arizona, and under emergency conditions, in Chanute, Kansas (CDM, 1992). Due to potential health hazards and regulatory difficulties however, health officials have discouraged these types of systems.

The number, size, and capacity of reuse projects is growing. Currently, there are more than 1,000 wastewater reuse projects in the United States (RMI, 1991). The Los Angeles Sanitation District is well known for its reclamation program which supplies over 66 million gallons of reclaimed water per day to 14 sites throughout the Los Angeles County (RMI, 1991).

2.4.4 Water Rationing

During periods of extreme drought conditions, water rationing can be implemented to achieve significant demand reductions. However, because large-scale reductions tend to decrease revenue from water sales, this type of conservation is used primarily for short-term emergency situations. Water rationing programs are most effective if the public is educated about the water supply problem and if water restrictions are enforced.

2.5 AN EXAMPLE CONSERVATION PROGRAM - GOLETA, CALIFORNIA

One of the best examples of successful water conservation is the program that the community of Goleta, California implemented during a recent emergency drought situation. Instead of developing additional water supplies, the Goleta Water District used incentive programs, rate structures, water metering, and public awareness programs in order to encourage the installation of water efficient fixtures and the use of efficient outdoor watering methods. Over 17,000 ultra low flush toilets were installed. Rebates were given for 14,700 of these toilets, while the remainder were installed primarily because they were required in all new construction, additions, and remodels after 1983. Furthermore, the program gave away approximately 35,000 high-performance showerheads, and hundreds of free on-site surveys identified more efficient outdoor watering methods. The district also imposed a mandatory water rationing plan to reduce use by a total of 15 percent.

Within one year of implementing this program, per capita residential water use fell by 50 percent and total water use fell by over 30 percent, from 135 to 90 gallons per capita day (gpcd). The program, which cost Goleta $1.5 million, resulted in savings which exceeded original water saving goals and it reduced sewage flow by over one-third, eliminating the need for a costly expansion of the wastewater treatment plant (RMI, 1991).

3.0 REGIONAL CONSERVATION SURVEY

The results of two water conservation surveys are presented in this section. Figure 6, Small Community Water Conservation Survey presents the results of a survey done by ACZ (1992) in order to compare the current conservation programs occurring in Steamboat Springs with those occurring in other small resort communities. The average per capita use among the 20 water districts surveyed (including the Mt. Werner and the City of Steamboat Springs Water Districts) is 224 gpcd, but water use rates ranged from 90 to 450 gpcd. (Water use volumes were supplied by each utility and likely calculated using different techniques. Thus, water use rates should be considered rough approximations.) The results of this survey indicate that the most widely used conservation programs are metering, the use of PRVs, new construction ordinances, outdoor water use restrictions, and public education. The percentage of water districts that are either currently using or are in the process of implementing these programs is as follows:

Commercial/Industrial Metering - 90%
Residential Metering - 75%
Pressure Reduction Valves - 75%
New Construction Ordinances - 65%
Outdoor Water Use Restrictions - 50%
Public Education - 50%

In order to compare the results of this survey with the trends of larger communities, a survey done in 1991 by the Colorado Water Utility Council was also obtained. The results of this report, in which 21 Colorado communities were surveyed, appear in Figure 7, Large Community Water Conservation Survey. The average per capita water use among these communities is 175 gpcd, which is less than the average use seen among the smaller communities surveyed above. However, the difference in these use rates is likely due to increases associated with tourism (water used by tourists is often calculated into the per capita water use rate of the permanent population of the town). The most widely used conservation programs among the larger communities are metering, public education, open-space irrigation management, and leak detection. It is interesting to note that only four of the larger communities surveyed (19 percent) have or are in the process of implementing a water conservation master plan. On the other hand, 14 of the smaller communities (70 percent) report that they have or are planning to have a conservation master plan. Another observation of these surveys is that retrofit programs are much more common in the larger communities. Presently, the only resort community in the ACZ survey to implement a retrofit program is Lake Tahoe, California.

COMMUNITY or UTILITY	Consumption (GPCD) (Include Tourists)	Residential Metering	Pricing Incentives - Residential	Commercial/Industrial Metering	Pricing Incentives - Commercial	Leak Detection	Pressure Reduction Valves	New Construction Ordinance - Low Flow Fixtures	Retrofit Program	Outdoor Water Use Restrictions	Open Space Irrigation Mgt.	Xeriscaping	Non-Potable Re-use	Public Education	Drought Plan	Master Plan	Recently Active Supply Augmentation	COMMENTS
Steamboat Springs	220	S	E	S	N	N	N	N	E	N	N	E	S	N	N	N	Y	
Mount Werner W.SD	220	S	S	S	S	N	Y	Y	E	N	N	N	N	N	N	S	Y	Proposing Reservoir Expansion
Winter Park W.S.D.	U	Y	S	Y	S	N	Y	Y	S	N	N	N	N	N	N	N		
Upper Eagle Valley Cm SD	137	Y	S	Y	S	Y	Y	S	S	N	N	S	N	Y	S	S		
Crested Butte	250	S	N	S	N	Y	Y	Y	N	Y	N	N	E	S	S	Y		Watershed Management - Just doubled Wastewater Treatment Plant Capacity
Telluride	212	N	N	Y	S	Y	Y	E	N	S	N	N	N	N	N	S	Y	
Glenwood Springs	450	S	S	S	S	Y	Y	S	E	Y	Y	N	N	S	Y	S	N	Designing New Treatment Plant
Aspen	260	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	N	Y	N	Y		
Snowmass WSD	90	S	S	S	S	N	S	Y	N	Y	Y	N	N	S	Y	Y	S	
Mid-Valley Metro W.D.	193	N	N	N	N	N	N	N	N	S	N	N	N	N	N	N		
Grand Co. WSD	120	Y	Y	Y	Y	N	N	S	N	N	N	N	N	Y	Y	S	Y	Automatic Treatment Plant
Cripple Creek	U	N	N	Y	S	N	Y	Y	N	N	N	N	E	N	N	N	Y	Planning New Wastewater Plant. Expanded Reservoirs Last Yr.
Basalt	300	Y	Y	Y	Y	Y	N	N	N	Y	S	N	N	N	S	S	Y	
Breckenridge	280	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	Y		
Dillon	346	N	N	N	N	S	S.	Y	N	N	N	N	N	N	N	N	Y	Buying Water Rights
Sundance, UT	110	S	N	S	N	Y	Y	N	N	N	N	N	N	S	N	S		
Park City, UT	243	Y	Y	Y	N	Y	Y	N	N	Y	Y	S	N	Y	N	S	Y	Continued Augmentation Incentives ($)
Taos, NM	153	Y	S	Y	S	N	S	Y	E	N	N	S	N	S	N	S	Y	New Wells New Wastewater Treatment Plant
Lake Tahoe, CA	225	N	N	Y	Y	S	Y	Y	Y	Y	Y	S	N	Y	Y	Y	Y	New Wells
Jackson, WY	U	Y	N	Y	N	S	Y	N	N	S	S	N	N	N	S	N		

NOTE: Consumption volumes were supplied by each utility and likely calculated using different techniques. These should be considered rough approximations.

LEGEND

Y=Yes
S=Starting or Some
E=Evaluating
W.S.D.=Water & Sanitation District
GPCD=Gallons Per Capita Per Day
W.D.=Water District
U=Unknown
N=No

Project No.: 828-1500	Design By: R. PETERSON	Scale: NO SCALE
File: SCWCS.DWG	Drawn By: T. CLARK	Date: DEC. 1992

ACZ inc
ENGINEERING AND ENVIRONMENTAL SERVICES
STEAMBOAT SPRINGS, CO 80477

FIGURE 6

FISH CREEK EIS

SMALL COMMUNITY WATER CONSERVATION SURVEY

1991 WATER CONSERVATION PROGRAM SURVEY	Gal/Cap/Day Consumption	Water Use Regulations	Comm/Indl. Programs	Lawn Size Restrictions	Retrofit/Plumbing Programs	Residential Metering	Pricing Incentives	Open Space Irrig. Mngmt.	Leak Detection/Loss Rdctn	Non-Potable Reuse	Water Audits	Lawn Watering Education	Xeriscape Education	Public Education	School Education	Conservation Master Plan	Peak Service Area Population	Total Annual Water Produced (BG)
Arvada	157	Y	S	E	Y	Y	Y	Y	Y	E	Y	Y	Y	Y	Y	Y	97,000	5.09
Aurora	160	Y	S	Y	Y	Y	Y	Y	Y	Y	S	Y	Y	Y	Y	Y	222,103	39.75
Berthoud	200	S	S	S	N	Y						S				N	3,300	0.23
Boulder	185				E	Y	Y	Y		E		Y	Y	Y	S	U	103,000	6.82
Clifton	100	N	N			Y			Y		Y					N	18,000	0.81
Colo. Springs	189	Y	Y	E	E	Y	N	Y	Y	Y	E	Y	Y	Y	Y	Y	303,900	23.60
Denver	229	Y	Y	E	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	926,000	72.04
Englewood	180	S				S		S	S	S	S	S	S	S		N	31,500	2.78
Fort Collins	240	Y	Y	N	Y	Y	S	Y	S	Y	S	Y	Y	Y	Y	U	92,000	9.29
Grand County	180	Y	Y	S	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	15,000	0.15
Grand Junction	197	N		N	S	Y	Y	Y	Y	Y	S	S	S	S	S	N	25,000	1.92
Greely	296					Y		Y	Y					Y				
Longmont	260					Y	S	S	S		S		S	Y	E	U	51,300	3.34
Loveland	126				S	Y			S				S	Y	Y	N	40,000	2.85
Northglenn	139					Y	Y	Y	Y		S	S	S	S	S	N	27,195	1.38
Pueblo	250	N		N	Y	Y	N	Y	Y	S	S	S	S	Y	S	N	108,300	7.99
Snowmass	90	Y		Y	Y				Y	Y	Y					N	varies	0.45
Thornton	126	S	S	S	S	Y	S	S	Y	S	S	S	S	Y	Y	N	74,000	4.42
Ute Water Consv	130	Y		N		Y		S	S	Y	S	S	S	Y	Y	N	82,000	2.30
W. Fort Collins	110					Y			Y			S		S	S	N	5,000	0.18
Westminster	145	N		N	Y	Y	Y	Y	S	Y	S			Y	Y	N	80,000	5.01

LEGEND

Y=Yes BG=Billion Gallons

N=No

S=Some

E=Evaluating

Source: Hobbs, 1991 (Used with the permission of the Colorado Water Utility Council)

Project No.: 828-1500	Design By: R. PETERSON	Scale: NO SCALE
File: WCPS.DWG	Drawn By: T. CLARK	Date: DEC. 1992

ACZ inc
ENGINEERING AND ENVIRONMENTAL SERVICES
STEAMBOAT SPRINGS, CO 80477

FIGURE 7

FISH CREEK EIS

LARGE COMMUNITY WATER CONSERVATION SURVEY

4.0 LOCAL WATER CONSERVATION PROGRAMS

At this time, neither the Mount Werner Water and Sanitation District (Mt. Werner) nor the City of Steamboat Springs (City) have formal water conservation plans. However, in order to comply with local and state law and in an effort to encourage future conservation, both districts are presently involved in various programs aimed at conserving water.

4.1 CITY OF STEAMBOAT SPRINGS

Information obtained on the City of Steamboat Springs was provided by Dan Birch (1992).

4.1.1 Metering/Rate Structuring

In order to delay the need to increase the capacity of treatment facilities and in accordance with Colorado's Water Metering Act of 1990, the installation of water meters in both the residential and commercial sectors of the City was completed in 1990, and meter based billing is expected to begin in early 1993. Although the City still uses a flat rate structure, data is being obtained from water meters in order to determine the rate structures that will be implemented in 1993. According to the City, residents will face an inclining block rate structure that will be initiated in phases over a three year period. During the first three years of implementation, service charges will decrease annually while volume charges per 1,000 gallons will increase annually. The advantage of this phased approach is that consumers can gradually implement different methods of conservation as they get accustomed to the rate structure. Commercial consumers, on the other hand, will face a declining block rate structure and will also be subject to a basic service charge.

4.1.2 System Maintenance

The City has recently begun replacing all of their main water lines. The program, which began five years ago, involves the replacement of approximately 40 miles of water pipes over a 30 year period. It is estimated that the entire system will be replaced by the year 2020. Although the City has no formal leak detection program included with the maintenance being done, the replacement of the water lines will reduce leakage and the installation of meters will increase the City's ability to determine the amount of water being lost to leaks.

4.1.3 Irrigation Restrictions

Lawn watering is restricted between the hours of 10:00 AM and 5:00 PM, but compliance is strictly voluntary as no enforcement of this regulation exists. The *Steamboat Today* publishes weekly irrigation requirements according to local precipitation patterns, and prescribes different homes to water on different days (according to address). Again, compliance with these guidelines is voluntary.

4.1.4 Raw Water Use

Raw, untreated water is currently taken from the Yampa River and used for snow-making at the Howelsen Hill Ski Area. The use of raw water, although not necessarily a conservation technique, helps to reduce the demand for potable water and thus results in treatment cost savings.

4.1.5 Xeriscape Grant

The City of Steamboat Springs has received a $19,000 grant from the Colorado State Office of Water Conservation (COWC) in order to partially fund the design and construction of a high-altitude xeriscape demonstration at Howelsen Hill Park. Intended to introduce the community to the idea of xeriscaping, the demonstration will compare the water use, maintenance, and visual appearance of a "xeriscape" to that of a "normal" landscape. In addition, a guide to water efficient landscapes in Colorado mountain communities will be developed. The demonstration is planned for the summer of 1993.

4.1.6 Plumbing Retrofit Grant

The City of Steamboat Springs has been selected as the test site for a study on the cost effectiveness of retrofitting tourist-oriented lodging complexes. The study will be conducted by the Northwest Colorado Council of Governments and will be funded by a $20,425 grant issued by the COWC. The study will analyze the water use patterns of tourists and will compare the water demand in retrofitted condominiums to demand in non-retrofitted condominiums. From the data obtained, the cost effectiveness of retrofitting large condominiums, including the potential savings that can result, will be determined. The findings of this study will be made available to all resort communities.

4.1.7 Pressure Reduction Valves

The City requires the use of PRVs in order to ensure that the water pressure in its system does not exceed 60 pounds psi. PRVs are installed, not only on main lines, but at each point of use in the system. The PRVs protect the system from fluctuations in water pressure and, in turn, increase the efficiency of the water system. Water pressure has direct effects on the flow rates of common plumbing fixtures and should thus be maintained at 50-60 psi for maximum efficiency.

4.2 MOUNT WERNER WATER AND SANITATION DISTRICT

Information obtained on the Mount Werner Water and Sanitation District was provided by John Fetcher (1992).

4.2.1 Metering/Rate Structuring

The installation of water meters in the residential and commercial sectors of the district was completed in 1991 and meter based began on January 1, 1993. Mt. Werner will use a different rate structure than the City. Consumers will be charged a base rate that includes a service charge and will receive 10 cubic meters (approximately 2,640 gallons) of water per month. Water usage above this monthly allotment will be billed on a per cubic meter basis. This rate structure will be used for both residential and commercial consumers.

4.2.2 Lawn Irrigation

Like the City, lawn watering in Mt. Werner is restricted between 10:00 AM and 5:00 PM and information on efficient irrigation is provided in the *Steamboat Today*.

4.2.3 New Construction Ordinance

According to Mt. Werner, their Rules and Regulations (April, 1991) require all new buildings constructed in the Mt. Werner Water District to have water efficient plumbing fixtures, including low flow toilets, low flow showerheads, and faucet aerators.

4.2.4 Pressure Reduction Valves

Mt. Werner requires the use of PRVs in order to ensure that the water pressure in their system does not exceed 60 inch psi. The PRVs protect the system from fluctuations in water pressure and, in turn, increase the efficiency of the water system.

4.2.5 Raw Water Use

Like the City, Mt. Werner promotes the use of raw water in some circumstances in order to reduce demand for treated water. The Steamboat Ski Area uses water from the Yampa River to make snow and the Sheraton Golf Course uses water from Fish Creek for irrigation.

4.2.6 Plumbing Retrofit Grant

The Mt. Werner Water and Sanitation District is assisting the City of Steamboat Springs with the study on the cost effectiveness of retrofitting condominiums with low flow devices.

5.0 REFERENCES

ACZ Inc. 1992. Water Resources Baseline Technical Report for the Fish Creek Reservoir EIS.

Birch, Dan. 1992. Personal Communication. City of Steamboat Springs.

Brown and Caldwell. 1984. Residential Water Conservation Projects - Summary Report for the United States Department of Housing and Urban Development.

Camp, Dresser, & McKee (CDM). 1992. City of Louisville Raw Water Master Plan.

Conserv 90: The National Conference and Exposition Offering Water Supply Solutions for the 1990's.

Danielson, Feldhake, and Hart. 1981. Urban Lawn Irrigation and Management Practices for Water Saving with Minimum Effect on Lawn Quality.

Fetcher,John. 1992. Personal Communication. Mount Werner Water and Sanitation District.

Maddaus, William O. 1987. Water Conservation. American Water Works Association, Denver, Colorado.

Managing limited Urban Water Supplies. Proceedings from the Conference for California Water Agencies (CWA). 1989.

Rocky Mountain Institute (RMI). 1991. Water Efficiency; A Resource for Utility Managers, Community Planners, and other Decision Makers.

United States Geological Survey. 1982. Before the Well Runs Dry; A Workshop on How to Design a Local Water Conservation Plan. USGS Open File Report 82-235.

Vranesh, George. 1991. Colorado Citizens Handbook; Colorado Water: The Next 100 Years.

APPENDIX D

INFILTRATION GALLERY ANALYSIS

Fish Creek Reservoir EIS
Infiltration Gallery Alternative Analysis
City of Steamboat Springs
January 11, 1993

INTRODUCTION

At the September 16, 1992, interagency meeting with the Forest Service, Corps of Engineers, Environmental Protection Agency, and Fish and Wildlife Service, mention was made of expanded infiltration galleries as a potential lesser impact water supply alternative to the reservoir enlargement. The purpose of this brief paper is to discuss and compare the reservoir enlargement and an expanded system of infiltration galleries.

BACKGROUND

The City and Mount Werner have both developed infiltration galleries (also known as well fields) to augment treated water provided from Fish Creek and the Fish Creek Filtration Plant. This has been done primarily to provide peaking capacity during high summer demands when landscape irrigation strains the capacity of the filtration plant. The galleries also provide a point of redundancy in the water supply system, providing the only completely independent means to place treated water into the distribution system.

The practice of Mount Werner and the City has not been to rely on the infiltration galleries to meet demands. Moreover, from a utility operation perspective as well as an environmental perspective, the expansion of the galleries in lieu of an enlarged Fish Creek reservoir is not desirable. The reasons for this include poor water quality, potential net depletions to the Yampa River, no instream flow on Fish Creek, greater Fish Creek reservoir drawdowns, excessive operational costs, and impacts to Puppy Dog Lake drainage. Each of these are discussed in greater detail in the following sections.

WATER QUALITY

Groundwater in the Yampa Valley generally is of poor quality because of high mineral content. Groundwater from Mount Werner's and the City's galleries have manganese and iron concentrations that exceed water quality standards by as much as an order of magnitude. While this presents no health impact, it produces an offensive tasting water that creates significant impacts such as staining of laundry and plumbing fixtures. It has also led to severe water quality problems in pools, including the health and recreation center pool. The pool has experienced water to have an emerald green color so deep that the bottom of the pool is not visible. This creates an unsafe situation and also greatly affects the pool's business.

While the galleries play an important role as a peaking supply and an emergency supply alternative, because of the obvious and serious water quality problems, the City and Mount Werner have sought to minimize their use.

YAMPA RIVER DEPLETIONS

The infiltration galleries may be operated under direct flow water rights with storage water available in Stagecoach Reservoir that may be released if the junior direct flow rights were ever called out of priority. A call has never been placed on this reach of the Yampa River, meaning it is not likely an appreciable amount of water would ever need to be released from Stagecoach to augment direct flow diversions. This would then mean that during late summer, fall, and winter months when habitat for threatened and endangered fish species is threatened by low flows, the galleries will be operating, creating further depletions to the Yampa River.

In contrast, because Fish Creek stores a portion of the spring runoff, use of Fish Creek reservoir provides for the release of storage water and augmentation of native flows over that same time period. Even considering consumptive losses, the net effect to the Yampa River will be an increase in flows during low flow months.

INSTREAM FLOW, RESERVOIR DRAWDOWN, AND OPERATIONAL COSTS

Presently, the infiltration gallery is remotely operated from the Fish Creek Filtration Plant. Greatly expanding the galleries and adding treatment to improve water quality to achieve a water quality comparable to Fish Creek water will not only represent a very high capital cost, but will also mean the galleries and their attendant treatment facilities will be continuously staffed by operators, creating high and inefficient operations costs. Operational costs will also be higher because treated water from the galleries is delivered into the distribution by means of high pressure pumps whereas the Fish Creek system is a gravity system.

Because of the high operational costs of the galleries, the inevitable operational practice that would result would be to maximize supplies from Fish Creek. This would lead to greater winter drawdowns that could threaten the lake fish population. It would also result in decreased Fish Creek instream flows below the intake to the Fish Creek Filtration Plant.

PUPPY DOG LAKE DRAINAGE

With the construction of the saddle dam and spillway during the last enlargement of Fish Creek Reservoir, flows which historically were routed down the Middle Fork of Fish Creek were routed through the Puppy Dog Lake drainage. Based upon field work undertaken through the EIS for the proposed reservoir expansion, it has come to light that these flows have evidently caused streambank erosion along the Puppy Dog Lake drainage. Evidently the flows routed through Puppy Dog Lake are much greater than native flows in the

Puppy Dog Lake basin.

The proposal to enlarge the reservoir will also include provisions to restore the historic routing of peak spring flows and any other flows that might be of such a magnitude to be erosive, through the Middle Fork of Fish Creek. Without the enlargement erosive flows would continue to be routed through the Puppy Dog Lake drainage.

cc: Council; Madsc

Steamboat Springs

Steamboat Springs Health & Recreation Association · 136 Lincoln Avenue · P.O. Box 1211 · Steamboat Springs, CO 80477 · 879-1828

October 1, 1992

Steamboat City Council
Box 775088
Steamboat Spgs, CO 80477

Dear City Council Members:

The Board of Directors has asked me to update you on some problems we incurred here at Health & Rec. because of the city putting a new well on line in late June.

Over that weekend in late June the water in the big pool turned inexplicably green and turbid even though we were treating it the same as we always did. We had many people give us negative comments and many leave because the water was too "dirty". Not knowing the cause, we drained the pool for a day to investigate. This caused us loss of revenue and many complaints. After calling in Crystal River Spas we found out other pools were having the same problems and that it was caused by the "new" city water. We then spent $600 on chemicals and many man hours turning the water back to its original state. Simultaneous to this the city turned off that well. The water returned to normal.

We were in contact with Dan Birch from the city the entire time and found him very cooperative. Dan has told us now that that well will be back on line this fall and again next summer.

The Board wants to let you know the situation and requests anything you can do to help with this problem. Because of our non-profit status and tight budgeting having to deal with this kind of water on an on-going basis would prove a severe hardship. If there is any way to pre-treat this water or let us know ahead of time what to do with it, it would help us considerably.

Please let me know if there is anything you can do to help with this problem. From a public relations aspect it is disastrous for us to have that kind of "dirty" water here.

Sincerely,

Patricia E. Carney
General Manager

APPENDIX E

EMERGENCY PREPAREDNESS PLAN

City of Steamboat Springs

MEMORANDUM

TO: Ed Burch, Routt County Sheriff
Roger Jensen, Chief of Police
Smokey Slaven, Captain of Ambulance Service
Jay Muhme, Fire Marshal
Ed Blank, Division Engineer

FROM: Joe Zimmerman, Utility Systems Superintendent JZ

DATE: July 17, 1992

SUBJECT: Emergency Preparedness Plan

Attached for your records is a copy of the City of Steamboat Springs Emergency Preparedness Plan. This plan is to be used in case of a dam failure on Fish Creek Reservoir.

Please review the plan and if you have comments, please submit them to me.

DATA SHEET

NAME OF DAM Fish Creek Reservoir

NAME OF DAM OWNER City of Steamboat Springs

* OWNERS REPRESENTATIVES RESPONSIBLE FOR EXECUTING THE EMERGENCY PLAN

	Name	Position	Contact at Phone
* 1.	Dan Birch	City Engineer	879-2060
* 2.	Joe Zimmerman	Utilities Super.	879-2060

PERSON RESPONSIBLE FOR DRAFTING AND UPDATING THIS PLAN Dan Birch

DAM LOCATION: Sec., 11 Twnship. 6N Rng. 83W PM 6th

RIVER OR STREAM Fish Creek COUNTY Routt

FOREST OR OTHER Routt National Forest

NEAREST TOWN IN FLOOD PLAIN Steamboat Springs

ESTIMATED TIME FOR FLOOD TO REACH NEAREST TOWN .5 HR

ESTIMATED TIME FOR FLOOD TO REACH NEAREST HOME .33 HR

DIRECTIONS FROM TOWN TO DAM 6.3 miles east

DAM HEIGHT 64 Ft., CAPACITY 1850 A.F.

SURFACE AREA 79.5 A.C., HAZARD RATING Class I

CREST LENGTH 650 Ft., CREST WIDTH 20 Ft.

MAX. OUTLET CAPACITY 3500 C.F.S.

SPILLWAY CAPACITY FOR EACH FOOT OF DEPTH

Same as Service Spillwa

Depth	Surcharge Storage	Service Spillway Capacity	Emergency Spillway Capacity
1 ft.	1900 AF	260 CFS	N/A CFS
2 ft.	1960 AF	720 CFS	N/A CFS
3 ft.	2040 AF	1320 CFS	N/A CFS
4 ft.	2140 AF	2110 CFS	N/A CFS
5 ft.	2260 AF	3225 CFS	N/A CFS
6 ft.	2410 AF	4700 CFS	N/A CFS

WHERE DRAWINGS & DAMSITE EQUIPMENT ARE KEPT City Offices.

137 10th Street, Steamboat Springs, Colorado

EMERGENCY PLAN

ESTIMATED TRAVEL TIME TO SITE

1. Arrange for immediate inspection of the site:

Person responsible Dan Birch

Person familiar with site to make inspection Dan Birch 1 hr.

Engineer to make inspection Dan Birch 1 hr.

2. Establish communication with participants:

Person responsible Dan Birch

Alternate Joe Zimmerman

3. Notify State Engineer's Office:

Water Commissioner Elvis Iacovetto 736-8308 (Home) 2 hr.
To make provision for increased flow downstream

Dam Safety Branch Sally Lewis 879-0272 (Office) 870-0476 (Home) 1 hr.
To inspect dam and recommend or concur with remedial action

4. Provide required equipment:

Owner can provide Loaders, backhoes, excavator, graders, trucks 3 hr.

Contractor "A" can provide - Loaders, excavators, dozers, trucks 3 hr.

Contractor "B" can provide - Same as A 3 hr.

Highway Department can provide - All State owned heavy equipment depending on seriousness of situation. unknown hr.

D.O.D.E.S. can provide - Facilitation and coordination with any and all resources available for emergency assistance statewide. hr.

Contractor "A" can provide - hr.

6. Provide required manpower:

Owner can provide 20-30 Personnel 1½ hr.

College "A" can provide - N/A hr.

U.S. Military can provide - Per State and National Disaster E.P.P. 2-4 hr.

Radio appeal can provide - Unknown hr.

7. Implement warning and/or evacuation:

Owner will - Notify public safetyagencies ½ hr.

D.O.D.E.S. will - Facilitate Search and Rescue operations with available agencies within the State. hr.

County Sheriff will - Coordinate all agencies involved in warning, excavation, and search and rescue operations. ½ hr.

State Patrol will - Assist the Sheriff's Department ½ hr.

Fire Department will - Assist the Sheriff's Department ½ hr.

8. Medical or other assistance:

Routt County Search & Rescue
Routt Memorial Hospital will provide EMT's, Search & Rescue, Ambulatory, Medical Services & Facilities ½ hr.

9. Helicopter Service:

will provide Search and Rescue Transportation, Ambulatory 1½ hr.

10. Engineering firm can provide Technical assistance in impeding, diverting repairing, and stopping dam breaks and water flows. hr.

11. Report on actions taken:

Person Responsible - Dan Birch hr.

DIRECTORY

OWNERS REPRESENTATIVES RESPONSIBLE FOR PLANNED ACTION & CONTACT LOCATION

Name	Position	Address	Phone
1. Dan Birch	City Engineer	137 10th Street	879-2060
2. Joe Zimmerman	Utility Sys. Supt	137 10th Street	879-2060
3. Kirk Madsen	Public Works Dir.	137 10th Street	879-2060
4. Roger Jensen	Chief of Police	840 Yampa Avenue	879-1144
5. Doug Marsh	Street Supt.	30415 Moffat Ave.	879-1807

CITY OF Steamboat Springs

Name	Position	Address	Phone
1. Dan Birch	City Engineer	137 10th Street	879-2060
2. Joe Zimmerman	Utility Sys. Supt.	137 10th Street	879-2060

COUNTY SHERIFF -

Name	Position	Address	Phone
1. Ed Burch	Sheriff	30007 W. U.S.40 Steamboat Spgs	879-1090 or 911
2. Art Fiebing	Under Sheriff	same as above	879-1090 or 911

OFFICE OF STATE ENGINEER

Name	Position	Address	Phone
Hal Simpson	Acting State Engineer	1313 Sherman Denver	866-3581
Alan Pearson	Dam Safety Branch	same as above	866-3581
Ed Blank	Division Engineer	320 Lincoln Steamboat Spgs	879-0272
Elvis Iacovetto	Water Commissioner	21400 3rd Oak Creek	736-8308

D.O.D.E.S.

Name	Position	Address	Phone
1. Jack Truby		24 hr. emergency	279-8855
2. Lynn Boulas		same as above	279-8855

AMBULANCE SERVICE

Name	Position	Address	Phone
1. Smokey Slaven	Captain	911 Yampa Avenue	879-7170
2. Matt Newman	Lt.	same as above	879-7170

HELICOPTER SERVICE

Name	Position	Address	Phone
1. Dynamic Aviation Helicopters		2225 South 3250 East Vernal, UT 84078	(801) 789-7200
2. Helicopter Roundup Services		Maybell, CO 81604	(303) 272-9931

DIVING SERVICE

Name	Position	Address	Phone
1. Jay Muhme	Fire Marshal	840 Yampa Ave.	879-0700
2. Roy Mack	Fireman	same as above	879-0700

OTHER

Name	Position	Address	Phone
1.			
2.			

PERSONS DOWNSTREAM FIRST AFFECTED BY FLOOD WATERS

Name	Address	Phone	No. of Residents
1.			
2.			
3.			
4.			
5.			
6.			

SEE NEXT PAGE

PERSONS DOWNSTREAM FIRST AFFECTED BY FLOOD WATERS

ADDRESS	NAME	PHONE	# OF RESIDENTS
1175 Steamboat Blvd.	Mount Werner Water & San.	879-2424	
1154 Anglers	C.A. Walker	Unknown	*
1158 Anglers	C.A. Walker	Unknown	*
1168 Fish Creek Lane	Bess Peebles	879-2996	1
1173 Fish Creek Lane	Heinz-Juargen Astein	879-5591	4
Fish Creek Lane	Hart Peebles	879-2915	*
1179 Fish Creek Lane	Francis Quinlan & Francisco Briseno	879-7673	*
Fish Creek Lane	Bob Snyder	879-2686	*
1184 Anglers Drive	Walter I. Waldrop	879-8561	*
1190 Anglers Drive	B.J. Powell	879-3362	6
1215 Anglers Drive	Chaparral Terraces 12 units		
550 Rollingstone Drive	Selbe Seniors Apts. 24 units		
1500 Pine Grove Road	H.K. Selbe	879-5450	2
1580 Pine Grove Road	Evangelical Free Church	879-3020	
1580 Pine Grove Road	Hampden Industries, Ltd.	879-0436	
1485 Pine Grove Road	Pine Grove Condos - A Complex	879-1535	
1485 Pine Grove Road	Pine Grove Condos - B Complex	879-1535	
1480 Pine Grove Road	James D. Selbe	879-0737	4
1250 S. Lincoln	Sundance Plaza	879-1600 x 596	
37500 U.S. Highway 40	Safeway	879-3766	
1450 S. Lincoln	Ski Haus	879-0385	
1475 Pine Grove Road	Pine Grove Center	879-0936	
1465 Pine Grove Road	Pine Grove Restaurant	879-1190	
1445 S. Lincoln	Big Country Reality	879-0728	
1355 S. Lincoln	American Fundware, Inc.	879-5770	
1255 S. Lincoln	Kinderhaus Day Care	879-3761	
1255 S. Lincoln	Fish Creek Campground		
1235 S. Lincoln	Kevin Harte	879-7753	6
1245 S. Lincoln	Fish Creek Trailer Park		65 Units

PERSONS DOWNSTREAM FIRST AFFECTED BY FLOOD WATERS

ADDRESS	NAME	PHONE	# OF RESIDENTS
1475 S. Lincoln	Mountain Resorts Laundry	879-3407	
1475 S. Lincoln	Ski Country Designs	879-2111	
1479 S. Lincoln	Yampa Valley Lumber	879-5550	
1485 S. Lincoln	Mountain West Environments	879-2313	
1445 S. Lincoln	Mount Werner Water & San Shop	879-2497	

* VACATION HOMES

DAM INCIDENT REPORT FORM

DATE ______________________________ TIME ______________________

NAME OF DAM ____

STREAM NAME ____

LOCATION ____

COUNTY ______________________________

NATURE OF PROBLEM ____

____

LOCATION OF PROBLEM AREA (LOOKING DOWNSTREAM) ______________

____

EXTENT OF PROBLEM AREA (MEASURE, PACE, OR ESTIMATE) ___________

____

ESTIMATED QUANTITY AND COLOR OR UNUSUAL FLOW _______________

____

WATER LEVEL IN RESERVOIR __________________________________

NAME OF PERSON WHO OBSERVED CONDITION _____________________

PHONE OR HOW TO CONTACT OBSERVER ________________________

WAS SITUATION WORSENING? __________________________________

DOES IT APPEAR TO BE AN EMERGENCY? ________________________

WHAT ARE CURRENT WEATHER CONDITIONS AT THE SITE? ____________

____

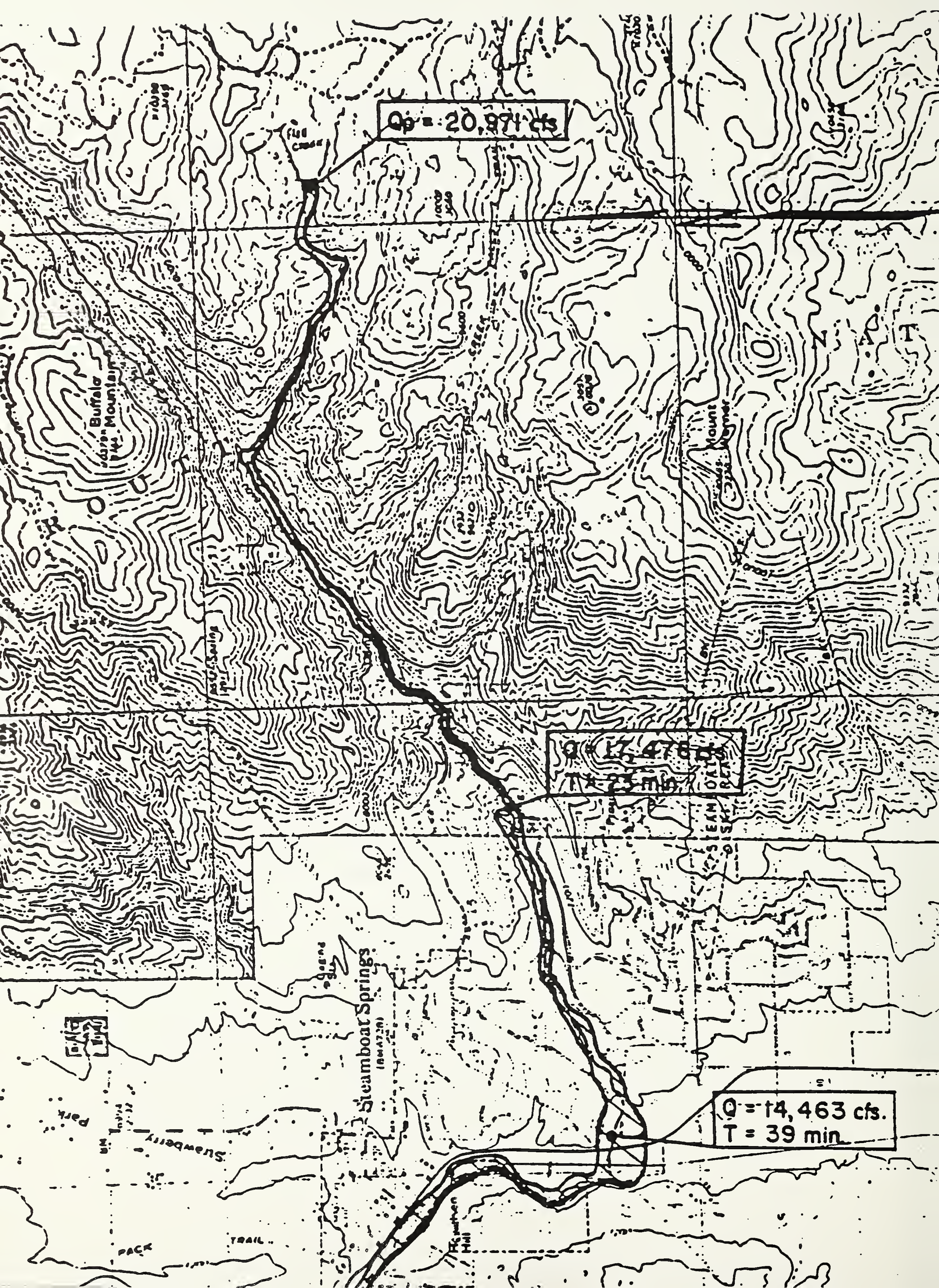
OTHER ____

____

____

____

____



Qp = 20,971 cfs
Q = 17,478 cfs
T = 23 min.
Q = 14,463 cfs.
T = 39 min.
Buffalo Mountain
Mount Werner
Steamboat Springs
PACK TRAIL


Q = 12,053 cfs.
T = 1hr. 11min.
Q = 8286 cfs.
Quarry
Saddle Mountain
Gulch
RIO GRANDE
Gravel Pits
Disposal Ponds
WESTERN
Oil Wells
Dill Hole

APPENDIX F

DAMBREAK ANALYSIS

Woodward-Clyde Consultants

Engineering & sciences applied to the earth & its environment

October 6, 1992

Mount Werner Water and Sanitation District
1175 Steamboat Boulevard
Steamboat Springs, CO 80488-339

Attention: Mr. John R. Fetcher, Secretary

Subject: Dambreak Analysis for Fish Creek Dam Enlargement, Routt County, Colorado
Project No. 22988 (T2)

Dear Mr. Fetcher:

Woodward-Clyde Consultants (WCC) has completed a dambreak analysis for inclusion into the Environmental Impact Study for the Fish Creek Dam. This analysis will assist in the design of the early warning system to evacuate the floodplain areas which would be inundated in case of a dam failure. The dambreak analysis consisted of a breach analysis for the existing dam at normal water surface elevation (WSEL) of 9866, an alternative dam raise at normal WSEL of 9875 and the proposed dam raise at a normal WSEL of 9886.

Methodologies

The dambreak analysis was performed using the U.S. Army Corps of Engineers, HEC-1 model. The "sunny day" dam failure parameters were developed from methodologies presented in the U.S. Department of Interior, Bureau of Reclamation, ACER Technical Memorandum No. 7. The "sunny day" failure was assumed to produce the worst case incremental flood in the Town of Steamboat Springs. This analysis is believed to be the worst case for the potential for loss of life due to the unexpected nature of the failure. If a flood due to a large rainfall event in conjunction with a dam failure was occurring, the potential of loss of life is believed to be less because residents living within the flood plain are aware of an on-coming flood due to rainfall. The parameters were calibrated to an empirical dambreak peak flow equation presented in ACER Technical Memorandum No. 7 and to peak flows from actual dam failures. The dambreak hydrograph was routed downstream in Fish Creek and the Yampa River through the Town of Steamboat Springs. The routing was performed using the normal depth storage routine in HEC-1.

22988/LE9 10-06-92(9:12am)/RPT

Stanford Place 3, Suite 1000 • 4582 South Ulster Street • Denver, Colorado 80237-2637
303-694-2770 • Fax 303-694-3946

Reservoir and Watershed Characteristics

The stage-storage curve used in the dambreak analysis was developed by Civil Design Consultants (CDC) in 1983 for the Evaluation of Fish Creek Reservoir Enlargement Alternatives Report. The water surface elevation for each of the alternatives and the corresponding volumes were input into the HEC-1 model for the dambreak analysis.

The cross sections used to route the dambreak hydrograph downstream were extrapolated from the U.S.G.S. quadrangles upstream of the Mount Werner Water Treatment Plant. The 2-foot contour maps of the Town of Steamboat Springs produced by D & D Consultants in 1972 and photo revised in 1979 were used downstream of the water treatment plant through the Town of Steamboat Springs on the Yampa River. The cross sections used within the corporate limits of the Town of Steamboat Springs are shown on Drawings 1 and 2. The Mannings "n" values for Fish Creek and the Yampa River were estimated during a site visit on August 31 and September 1, 1992. The stream stationing was estimated from the U.S.G.S. quadrangle maps.

Due to the type of modelling used in this analysis, the amount of flow which would travel upstream on the Yampa River at its confluence with Fish Creek from a flood wave traveling downstream on Fish Creek was neglected. This should result in a conservative estimate of the flood peaks, depths and travel times downstream on the Yampa River.

There are two U.S.G.S. gage stations located within the study area. One gage (U.S.G.S. Station # 09238900) is located on Fish Creek near the Mt. Werner Water Treatment Plant and the other gage (U.S.G.S. Station # 09239500) is located on the Yampa River at the 5th Street Bridge. The Fish Creek gage has a published period, of 15 years, from 1967 through 1990. The Yampa River gage at Steamboat Springs has a published period of record, of 83 years, from 1905 through 1990.

Table 1 summarizes WCC's flow-frequency analysis using the log-Pearson Type III statistical analysis for the two U.S.G.S. gages. A log-Pearson Type III analysis uses the maximum flood peak in a water year for the period of record to develop a statistical flow-frequency curve. The maximum flood peaks for the period of record for both gages are from the months of April, May and June. The floods which occur during these months are typically associated with snowmelt. Therefore, it is assumed there have not been any recorded flood peaks associated with rainfall events.

The Federal Emergency Management Agency (FEMA), in 1976, conducted a flood insurance study (FIS) for the Town of Steamboat Springs. The FIS presented a flow - frequency analysis which included both a snowmelt analysis and was supplemented with a rainfall-runoff analysis for the higher frequency events. The FIS report did not state how the rainfall-runoff analysis was performed. The results of the FEMA study are summarized in Table 1. The log-Pearson Type III analysis and the FIS results are presented for comparing the flood peaks associated with flood flows and the dambreak.

Dam Breach Parameters

A dam breach can be defined as a failure of any reservoir structure which allows an uncontrollable discharge of water. Typically, a failure results from overtopping of the dam or piping. The proposed dam will be designed to pass the probable maximum flood (PMF) without overtopping. Therefore, for this investigation a piping failure is assumed. The piping failure is assumed to occur with the reservoir at the crest of the spillway. This type of analysis is typically called a "sunny day" dam failure.

The following regression equation, based on actual dam failures, is used to estimate peak discharges:

$$Q = 39\,(D)^{1.81}\,(S)^{0.061}$$

Q - Peak discharge (cfs)
D - Depth of water behind dam at time of failure (ft)
S - Volume of storage at time of failure (ac-ft)

The regression equation is based only on the depth of storage and the volume of storage in the reservoir. The predicted results from the regression equation were compared to actual dam failures to check if the results were within a reasonable range for similar failures.

To predict the peak flow resulting from a dam failure the breach width, breach side slopes and time of failure must be estimated. Based on ACER Technical Memorandum No. 7, the breach width can vary from 0.5 to 3.0 times the height of the dam, the side slopes can vary from 0:1 to 1:1 and the failure time can ranged from 0.5 to 4.0 hours. These parameters which were input into HEC-1 and were calibrated to the regression equation presented in ACER Technical Memorandum No. 7.

Analyses/Results

The existing dam has a hydraulic height of 46 feet (elevation 9820 is assumed zero storage from the stage-storage curve in the CDC, 1983 Report) with a WSEL of 9866 and storage volume of 1840 ac-ft (CDC, 1983). The regression equation predicted a peak discharge of 63,100 cfs. There were two similar published dam failures which have occurred, the Buffalo Creek, WV and the Laurel Run, PA dam failures. The Buffalo Creek dam had a depth of 46 ft. and a storage volume of 404 ac-ft which resulted in a 50,000 cfs peak discharge. The Laurel Run dam had a depth of 42 ft. and a storage volume of 310 ac-ft which resulted in a 37,000 cfs peak discharge. Although the two similar dam failures did not have as much storage volume as the existing dam, the predicted results were assumed to be within reason.

The calibrated dam breach parameters input into HEC-1 for the existing dam are a maximum breach width of 138 ft, side slopes of 0:1 and time of failure of 0.9 hrs. These parameters resulted in a peak discharge of 63,200 cfs.

The dam failure hydrograph was routed downstream and the results at selected locations are presented in Table 2. An apparent anomaly exists downstream of the Fish Creek Dam on Fish Creek at the Mount Werner Water Treatment Plant. The flow is decreasing while the flow depth is increasing. This may be explained because the gradient of the creek is reduced naturally in the downstream direction. The slope of the channel is 0.0975 ft/ft at the upstream end and 0.0167 ft/ft at the downstream end of the stream.

The alternative dam raise has a hydraulic height of 55 ft. with a WSEL of 9875 and a storage volume of 2,750 ac-ft (CDC, 1983). The regression equation predicts a peak discharge of 89,300 cfs. There were no published dam failures in ACER Technical Memorandum No. 7 which were similar in dam height and volume.

The calibrated dam breach parameters input into HEC-1 for the alternative dam raise are a maximum breach width of 165 ft, side slopes of 0:1 and a time of failure of 0.7 hrs. These parameters resulted in a peak discharge of 80,400 cfs. The dam failure hydrograph was routed downstream and the results are presented in Table 2.

The proposed dam raise has a hydraulic height of 66 ft, a WSEL of 9886 and a storage volume of 4,140 ac-ft (CDC, 1983). The regression equation predicts a peak flow of 127,400 cfs. There was one published dam failure for a reservoir located in

Castlewood, CO which had a depth of 70 ft and a storage volume of 5,000 ac-ft which resulted in a peak discharge of 126,000 cfs.

The calibrated dam breach parameters input into HEC-1 for the proposed dam raise are a maximum breach width of 198 ft, side slopes of 0:1, and a time of failure of 0.7 hrs. The resulting peak flow using the calibrated breach parameters is 136,200 cfs. The dam failure hydrograph was routed downstream and the results are presented in Table 2.

An estimated flood wave 17 ft. deep and a peak discharge of 41,100 cfs would reach the Mount Werner Water Treatment Plant on Fish Creek in 1.1 hours if there was a failure of the existing dam at normal water level. An estimated flood wave 23 feet deep and a peak discharge of 103,700 cfs in 0.9 hours would reach the same location if there was a failure of the proposed dam at normal water level..

An estimated flood wave 11 ft. deep and a peak discharge of 26,200 cfs would reach the downtown area of Steamboat Springs in 1.7 hours if there was a failure of the existing dam at normal water level. An estimated flood wave 16 feet deep and a peak discharge of 69,400 cfs in 1.2 hours would reach the same location if there was a failure of the proposed dam at normal water level.

A map showing the estimated flood inundation limits for the Town of Steamboat Springs resulting from a dam failure of the proposed dam raise is shown on Drawings 1 and 2. The map used for Figure 1 does not extend from the Mt. Werner Water Treatment Plant upstream to the Fish Creek Dam. It is WCC's understanding that there are no permanent structures in this reach of stream. The base map does not extend downstream on the Yampa River from the confluence of Fish Creek and does not extend on the west side the Yampa River near Riverside Drive. The flood inundation map shown has been extrapolated in both of the areas from the U.S.G.S. map.

Studies and analyses for this report were performed by John Sikora, under the direction of Dan Johnson, Project Manager. Dr. John Andrews reviewed and approved this report. Information was provided by Mr. Dan Birch of the City of Steamboat Springs.

Opinions and analysis for the Fish Creek dambreak are presented in this report. They are based partly on technical analysis and available information, partly on our understanding of site conditions and partly on our general experience with projects of a similar nature.

Woodward-Clyde warrants that our services are performed within the limits prescribed by our Clients, with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended in our proposals, contracts or reports.

If you have any questions regarding the dambreak analysis please do not hesitate to call.

Sincerely,

John W. Andrew
Associate

Daniel C. Johnson
Principal

JHS:art

(1 copy sent)

1c: Dan Birch, City Engineer, Town of Steamboat Springs
File

TABLE 1

FLOW-FREQUENCY AND FEMA FIS RESULTS
U.S.G.S. GAGE STATION FREQUENCY ANALYSIS RESULTS

Return Period (yrs)	Fish Creek @ Mt. Werner WTP (cfs)	Yampa River @ 5th St. Bridge (cfs)
500	1050	6420
100	960	5870
50	920	5590
10	810	4730
5	750	4230

FEMA FLOOD INSURANCE STUDY RESULTS

Return Period (yrs)	Fish Creek @ Mt. Werner WTP (cfs)	Yampa River @ 5th St. Bridge (cfs)
500	4,600	20,000
100	1,800	8,000
50	1,400	6,500
10	1,100	5,300

TABLE 2

RESULTS OF DAMBREAK ANALYSIS FOR FISH CREEK RESERVOIR

	Existing Dam WSEL @ 9866			Alternative Dam Raise @ WSEL 9875			Proposed Dam Raise @ WSEL 9886		
Location	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)	Peak Flow (cfs)	Peak Depth (ft)	Time[1] (hrs)
Fish Creek Downstream of Dam	63,200	12	0.9	80,400	13	0.7	136,200	16	0.7
Fish Creek @ Mt. Werner Water Treatment Plant	41,100	17	1.1	61,300	19	0.9	103,700	23	0.9
Fish Creek @ Highway 40	35,000	20	1.3	52,700	23	1.0	89,200	28	1.0
Yampa River @ 2nd Street	26,200	11	1.7	41,200	13	1.3	69,400	16	1.2
Yampa River @ 7th Street	25,800	11	1.7	40,500	13	1.3	68,100	16	1.2
Yampa River @ Riverside Dr.	20,800	10	1.9	33,900	11	1.5	56,900	13	1.4

[1] Cumulative time from beginning of dam failure.

APPENDIX G

COLORADO WATER CONSERVATION BOARD STIPULATION

DISTRICT COURT, WATER DIVISION NO. 6, COLORADO

Case No. 92CW023

STIPULATION

CONCERNING THE APPLICATION FOR WATER STORAGE RIGHTS OF THE CITY OF STEAMBOAT SPRINGS

IN ROUTT COUNTY, COLORADO

The Applicant, the City of Steamboat Springs ("City"), and the objector, the Colorado Water Conservation Board ("CWCB"), by and through their respective attorneys, hereby stipulate as follows:

1. In this case, the City seeks a decree for a conditional water storage right of 200 AF for the proposed enlargement of Fish Creek Reservoir, in Routt County.

2. The CWCB holds instream flow water rights decreed in Case No. W1371-77 on Granite Creek for 4 cfs and in Case No. W1372-77 for 2 cfs on Middle Fork of Fish Creek, both with appropriation dates of September 23, 1977.

3. The CWCB has objected to the application of the City, claiming that the decree sought herein will injure the said CWCB instream flow water rights if the City stores 200 AF of water in an enlargement to Fish Creek Reservoir under a decree which may be granted in this case.

4. The City disputes the CWCB claim.

5. For the purpose of resolving the controversy between the City and the CWCB in this case, the City and CWCB agree that the Court may enter a conditional decree for the water right applied for in this case in accordance with the application, provided that such decree shall contain the following conditions and provisions:

(a) No water shall be stored in the Fish Creek Reservoir enlargement pursuant to the decree in this case until and unless the City and the CWCB have entered into and executed a donation contract or agreement, approved by appropriate resolution of both the City and the CWCB.

(b) The City will use reasonable efforts to construct additional habitat improvement structures in Fish Creek downstream from the Mt. Werner Pipeline intake prior to the storage of water in Fish Creek Reservoir enlargement under the decree in this case, subject to

(c) obtaining access permission from riparian landowners and obtaining all necessary governmental permits to do so, provided that the cost of such additional improvements (including the value of in-kind services provided thereto) shall not in any event exceed $10,000.00 (adjusted to account for inflation), less the cost and in-kind value of the habitat improvements already made by the City in Fish Creek in 1991.

(c) The above provisions of (a) and (b) shall be conditions and limitations on the 200 AF of water decreed to the City in this case, and shall run with the ownership of such water right and be binding upon the City and its successors and assigns to such right.

6. The City shall provide the CWCB with a copy of any proposed decree to be submitted to the Court in this case, and any such proposed decree shall incorporate the terms of paragraph 5 above. The CWCB shall not oppose any such decree that is consistent with the terms and conditions contained in paragraph 5 above. In the event the application in this case is tried to the Court, the City agrees to seek a decree with terms no less protective of the CWCB and the instream flows in Fish Creek than the stipulation and agreement described in paragraph 5 above.

7. The CWCB agrees that it will not object to any decree that contains terms and conditions at least as restrictive on the City as those contained in this stipulation, and further agrees that such a decree may be entered by the Court in conformance with the application and this stipulation, irrespective of the Statement of Opposition by the CWCB.

DATED this 31st day of December, 1992.

SHARP AND BARNEY

Thomas R. Sharp #0722
401 Lincoln Ave
P.O. Box 774608
Steamboat Springs, CO 80477

Telephone 303-879-7600

FOR THE ATTORNEY GENERAL

Steven O. Sims #9961
Assistant Attorney General
Natural Resources Section
1525 Sherman Street, 5th Floor
Denver, CO 80203
Telephone 303-866-5129

City of
Steamboat Springs

January 27, 1993

Ms. Wendy Schmitzer
Routt National Forest Supervisors Office
Riverside Center
Steamboat Springs, CO 80487

Dear Wendy:

This letter outlines the City of Steamboat Springs' (City) and Mount Werner Water and Sanitation District's (District) commitment to utilize 200-acre-feet of the proposed 2200 acre-feet enlargement of Fish Creek Reservoir for instream flow. This is in accordance with the commitment already made to the Colorado Water Conservation Board (CWCB), the sole entity by state statute that may hold an instream flow right in Colorado.

The City and Mount Werner will reserve and store within the enlarged Fish Creek reservoir 200 acre-feet of water, the primary purpose of which will be to augment the CWCB instream flow right of 2.0 cfs on Fish Creek for the reach below the water filtration plant intake to the confluence with the Yampa River. The City and District agree to release up to the 200 acre-foot volume in any year in order to satisfy the 2.0 cfs requirement for the reach.

The 200 acre-feet will be reserved and used exclusively for instream flow purposes except in the event of severe drought or water emergency such that no other source of storage water is available to meet municipal demands of the City and District.

The City and District agree to monitor stream flow and call for administration of the stream by the Division Engineer of the Colorado Department of Natural Resources to ensure storage water released for instream flow purposes is not diverted by other water users on the subject reach.

Sincerely,

CITY OF STEAMBOAT SPRINGS

Daniel R. Birch
City Engineer/Assistant Utilities Director

cc: John Fetcher, Mount Werner Water and Sanitation District
Jean Ray, ACZ

P.O. Box 775088, Steamboat Springs, Colorado 80477
City Hall - 879-2060; Utility Accounting - 879-6993; Police - 879-1144; Public Works Shop - 879-1807

APPENDIX H

CITY & MT. WERNER METERING RATES

CITY OF STEAMBOAT SPRINGS
137 10th Street P.O. Box 775088
Steamboat Springs, Colorado 80477
(303) 879-6993

October 20, 1992

Dear Residential Utility Customer:

The Steamboat Springs City Council is currently evaluating various water/sewer billing rate structures. It is Council's desire that you have the opportunity to voice your opinion regarding the rate structure selected.

Selecting a rate structure is a difficult task. The new billing method using meters for determining water/sewer charges will make each customer's bill unique. The charges will be directly related to the amount of water used. Much consideration has been given to keeping charges fair and equitable.

Attached is a list of twelve(12) months of your water meter readings. The proposed rate structure for year 1 has been applied to these readings to provide you with a sampling of the impact to your charges. Compare the monthly charge provided with your current bill. Please note that your current bill is a quarterly charge and must be divided by three(3) to determine the current monthly charge for comparison. For example, the standard residential combined water and sewer bill is $38.00 per month per dwelling unit.

Below is a table of the currently proposed rate structure.

RESIDENTIAL RATES

		YEAR 1	YEAR 2	YEAR 3
VOLUME RATE/1000 GALS:				
WATER-	BLOCK 1 (0 TO 6)	$0.50	$1.10	$1.55
	BLOCK 2 (6 TO 25)	1.00	2.20	3.20
	BLOCK 3 (25+)	2.50	3.50	4.00
SEWER-		$1.40	$2.20	$2.60
SERVICE CHARGE(PER UNIT)				
WATER-		$15.00	$10.00	$6.00
SEWER-		10.00	6.00	4.00

This structure consists of several elements. Rates are divided into water and sewer volume charges and service charges. Water rates are broken down into three volume usage blocks. Residential monthly water rates increase for each thousand gallons used as usage moves from one volume block to another. For example, in year one, a residence using 8 thousand gallons will be charged $0.50 per thousand gallons for the first 6 thousand gallons ($3.00) and $1.00 per thousand gallons for the next 2 thousand gallons ($2.00) or a

total of $5.00 for 8 thousand gallons.

Residential monthly sewer volume rates are fixed for a year at a time and are based on the average monthly water usage for the winter months of November, December, January and February. This method is used so that your sewer charges do not increase when you start irrigating a lawn or garden in the summer. Irrigation water does not enter the sewer system for treatment.

There will also be a fixed monthly service charge, per dwelling unit, for both water and sewer. The service charge will be the minimum charge, per dwelling unit, if no water is used. Per the rate table please notice that the service charges decrease and the volume charges increase over a three year period. This implementation method has been selected to provide a gradual adjustment from the current flat rate system to a volume rate system. This phase-in process will allow you to analyze your water usage and to make adjustments as more of your charge is converted to a volume charge each year.

Please review your sample charges and the attached rate sheet. Note that if your meter is used to meter more than one unit, the charges listed are the total charges for water used by all units. The "Number of Dwelling Units" item at the top of the table identifies the number of units served by your meter. If you have any questions please call (303)879-6993. If your meter was first installed during the past twelve(12) month period your first meter reading may reflect usage for more than thirty(30) days. In this case, your first reading charges and the printed charges for earlier months should be ignored as the charges will not be accurate.

City Council will be meeting on November 3, 1992 at 7:30 P.M. at the Public Safety building to discuss the proposed rate structure. Your attendance and comments will be welcome and appreciated.

Mt. Werner Water & Sanitation District

6 November 1992

Dear Customer:

On 1 January 1993 the Mt. Werner Water and Sanitation District will switch from a flat rate charge to metered water service to encourage conservation and to comply with Colorado law. This move could very well delay the capital expense of expanding the water filtration and sewage treatment plants.

The flat or base rate for an Equivalent Residential Unit (ERU), including condominiums, will change from $8 to $10 per month for water. According to plan, each ERU will receive 10 cubic meters (CM) per month or 30 CM per quarter for the base rate of $30 per quarter (1CM = 264 gallons.) Water use over 30 CM will be billed at $0.25 per CM, which equals $0.95 per 1000 gallons. Please notice the figures at the top left of your statement. They represent your previous reading, current reading and the cubic meters used for 3rd Quarter 1992 (July, August, September). Water usage for apartments or condominiums with several meters are on the enclosed sheet.

For example, if a single family residence (ERU) usage is 50 CM, the charge for water for that quarter would be $30 flat rate plus $5 = $35. The $5 charge is calculated as follows: (50 CM - 30 CM) x $0.25 = $5.00. The sewer charge will be $30 per quarter. In spite of the planned increase your charges for water and sewer service will be, in most cases, the lowest in the state for comparable districts.

The good news is that the District's outstanding bonds were paid off in April and as a result the 1.44 mill levy will be eliminated in 1993. This will reduce your real estate tax by an amount equal to 0.00144 times your assessed valuation.

Because the District, now and in the past, bills the flat rate in advance, you will not receive a bill for the first quarter of 1993 until April when we start billing retroactively under metered service.

MT. WERNER WATER AND SANITATION DISTRICT

John R. Fetcher

John R. Fetcher, Manager

Mailing Address:
Steamboat Springs,
Colorado 80488-0339

Phone:
(303) 879-2424

Location:
Fish Creek Filtration Plant
1175 Steamboat Blvd.

APPENDIX I

CITY COUNCIL RESOLUTION & RESERVOIR FINANCIAL PLAN

RESOLUTION NO. 92-44

A RESOLUTION FINDING AND DECLARING A PUBLIC NECESSITY AND PUBLIC PURPOSE IN THE ENLARGEMENT OF FISH CREEK RESERVOIR; TO AUTHORIZE SUCH ENLARGEMENT AS A JOINT PROJECT WITH JOINT OWNERSHIP BY THE CITY AND THE MOUNT WERNER WATER AND SANITATION DISTRICT AND TO AUTHORIZE A COST SHARE FOR SUCH ENLARGEMENT WITH THE MOUNT WERNER WATER AND SANITATION DISTRICT.

WHEREAS, the City of Steamboat Springs, Colorado is the owner of the existing Fish Creek Dam and Reservoir with an active capacity of 1843 acre-feet; and

WHEREAS, the Mount Werner Water and Sanitation District needs and desires to obtain a source of storage water in the Fish Creek Basin where they presently have none; and

WHEREAS, the Mount Werner Water and Sanitation District wishes to enlarge the existing reservoir by 2200 acre-feet and wishes to have the City participate in the costs and share in the additional supply of storage water so created; and

WHEREAS the Mount Werner Water and Sanitation District by Resolution dated August 7, 1992 has authorized financing of the enlargement in an aggregate amount not to exceed $4,630,000.00 with the Colorado Water Resources and Power Development Authority ("Authority"); and

WHEREAS the City has a 2,000 acre foot conditional water right on Fish Creek Reservoir decreed in 80 CW 255 in District Court for Water Division NO. 6 on April 30, 1981, for which a Diligence Decree was entered by the Court in 85 CW 44 on August 8, 1985 and 89 CW 39 on December 7, 1989; and

WHEREAS the City has filed in District Court for Water Division No. 6 on June 30, 1992 in 92 CW 23 an application which is currently pending for an additional 200 acre foot conditional storage right on Fish Creek Reservoir; and

WHEREAS the conditional water rights decreed and pending reflect planning to anticipate the need for additional water supplies in a growing community; and

WHEREAS the City wishes to share the Fish Creek Reservoir conditional water rights decreed and pending with the Mount Werner Water and Sanitation District; and

WHEREAS the City has an ample supply of storage water to meet near term demands but wishes to participate in the enlargement to help meet long term water demands; and

WHEREAS the City recognizes problems with low flows on Fish Creek during certain periods of the year and wishes to utilize a portion

of the additional amount of storage water for release to augment instream flows.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF STEAMBOAT SPRINGS, COLORADO, THAT:

1. The City hereby agrees to contribute $175,000 per annum to the debt retirement of the project beginning in the year 2000 and continuing for a total of twelve years constituting a total contribution not to exceed $2,100,000; Mount Werner Water and Sanitation District to pay all remaining costs related to the expansion. The City Agreement in this paragraph is subject to the condition that Mount Werner Water and Sanitation District first agree with the City that the District will not expend borrowed funds received from the Authority net of issuance cost, until the District and/or City have obtained permits from the Army Corps of Engineers and the U.S. Forest Service, and Routt County to complete the enlargement.

2. The City recognizes that the City and Mt. Werner Water and Sanitation District will share ownership to the storage water in proportion to the amounts each contributes to fund and finance the enlargement.

3. The City Council hereby directs and authorizes the City Manager and the City Council President to discuss and preliminarily approve any agreements or documents necessary to complete the enlargement of the reservoir and financing for the enlargement. The City Council expressly reserves the right to consider and finally approve any and all such agreements and documents.
PASSED, ADOPTED AND APPROVED this 25th day of August 1992.

Mary T. Brown
MARY ~~T.~~ BROWN
City Council President

ATTEST:

Marty Alexandroff
Marty Alexandroff, City Clerk

FISH CREEK RESERVOIR ENLARGEMENT - FINANCIAL PROGRAM

COLORADO WATER RESOURCES AND POWER DEVELOPMENT AUTHORITY

1992 SMALL WATER RESOURCES PROGRAM - SERIES B

	ANNUAL REVENUES						ANNUAL EXPENDITURES			
	CITY OF STEAMBOAT SPRINGS		MT. WERNER WATER DISTRICT				DEVELOPMENT AUTHORITY LOAN			
of	Contribution &		Service Charge Increase			City District	20yrs@7%	Emergency		TOTAL ANNUAL
ion	Tax Rebate	O & M	Water	Sewer	Meters	Total	4,630,000	Reserve	O & M	EXPENSE
1	200,000	10,000	82,000	82,000	105,000	479,000	248,380	3,000	10,000	261,380
2	200,000	10,000	82,000	82,000	105,000	479,000	326.767	3,000	10,000	339,767
3	200,000	10,000	84,000	84,000	107,000	485,000	400,580	3,000	10,000	413,580
4	200,000	15,000	84,000	84,000	107,000	490,000	398,980	3,000	15,000	416,980
5	200,000	15,000	84,000	84,000	107,000	490,000	401,773	3,000	15,000	419,773
6	200,000	15,000	86,000	86,000	109,000	496,000	398,770	3,000	15,000	416,770
7	200,000	15,000	86,000	86,000	109,000	496,000	400,185	3,000	15,000	418,185
8	200,000	20,000	86,000	86,000	109,000	501,000	400,735	3,000	20,000	423,735
9	175,000	20,000	88,000	88,000	111,000	482,000	400,475	3,000	20,000	423,475
10	175,000	20,000	88,000	88,000	111,000	482,000	399,375	3,000	20,000	422,375
11	175,000	20,000	88,000	88,000	111,000	482,000	397,510		20,000	417,510
12	175,000	25,000	90,000	90,000	111,000	491,000	399,860		25,000	424,860
13	175,000	25,000	90,000	90,000	111,000	491,000	401,113		25,000	426,113
14	175,000	25,000	90,000	90,000	111,000	491,000	401,237		25,000	426,237
15	175,000	25,000	92,000	92,000	113,000	497,000	400,338		25.000	425,338
16	175,000	25,000	92,000	92,000	113,000	497,000	396,398		25,000	421,398
17	175,000	25,000	92,000	92,000	113,000	497,000	400,403		25,000	425,403
18	175,000	25,000	94,000	94,000	113,000	501,000	401,030		25,000	426,030
19	175,000	25,000	94,000	94,000	113,000	501,000	400,260		25,000	425,260
20	175,000	25,000	94,000	94,000	113,000	501,000	398,250		25,000	423,250
	3,700,000	395,000	1,766,000	1,766,000	2,202,000	9829000	7,772,419	30,000	395,000	8,197419

REVISED :

REVENUES FOR THE FIRST 8 YEARS IN COLUMN 1 OF $200,000 PER YEAR ARE DISTRICT FUNDS RECEIVED FROM THE CITY AS A PROPERTY TAX REBATE. STARTING IN YEAR 9 THROUGH 20, THE CITY OF STEAMBOAT SPRINGS WILL CONTRIBUTE $175,000 ANNUALLY TOWARD DEBT SERVICE.

J.R. FET(

APPENDIX J

BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT
for the
FISH CREEK RESERVOIR EXPANSION PROJECT
on the
ROUTT NATIONAL FOREST

Introduction

The Endangered Species Act of 1973 (the Act) requires Federal agencies to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species." The purpose of the Act is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" and "to provide a program for the conservation of such endangered species and threatened species... ."

Section 4 of the Act (Determination of Endangered Species or Threatened Species) grants the Secretary of the Interior power to determine whether any species is considered threatened or endangered, based on the present status of the species such as population numbers, limited habitat, disease, existing regulatory mechanisms, or any man-made influences jeopardizing the species' continuing existence.

Section 7 of the Act (Interagency Cooperation) specifies that, to more effectively carry out the purpose of the Act, all other Federal departments and agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities by "taking such action necessary to insure that actions authorized, funded, or carried out by them (Federal departments and agencies) do not jeopardize the continued existence of any listed species (pursuant to Section 4) or result in the destruction or modification of critical habitat of such species."

The consultation process is designed to assist Federal agencies when complying with the Act, and authority of consultation has been delegated by the Secretary of the Interior to the Director of the U.S. Fish and Wildlife Service (USFWS). The consultation process involves several phases. First, a general description of the proposed action and a formal request for a listing of proposed, candidate, and listed endangered and threatened species potentially affected by the proposed action is submitted to the USFWS by the affected agency. The USFWS responds with a list of proposed, candidate, and listed species within the proposed Project Area. When the project is a construction project, the agency then prepares a Biological Assessment which identifies the project, details the biology of listed and proposed species on the list submitted by the USFWS, analyzes the cumulative effects of the project, and determines if there is likely to be an effect (either beneficial or adverse) on any listed or proposed species. If a "may affect" determination is made, the agency must request formal consultation with the USFWS.

Formal consultation involves USFWS consideration of the proposed project and how it may affect the biology of any listed threatened or endangered species, including the magnitude of such effects and potential cumulative effects. Based on this information, a Biological Opinion is issued by the USFWS which states one of three possible conclusions: the proposed action (1) may promote the continued existence of the species, (2) is not likely to jeopardize the continued existence of the species, or (3) is likely to jeopardize the continued existence of the species. Reasonable and prudent alternatives must be addressed by the USFWS as part of the Biological Opinion when a determination is made that the proposed project is likely to jeopardize the continued existence of the species.

The USFWS, in a letter to the Routt National Forest (dated 5/19/92), provided a list of Threatened, Endangered, and Proposed Species which might occur within the influence of the proposed Fish Creek Reservoir expansion project (Rose, pers. comm. 1992). Species referenced were five endangered species: bald eagle (*Haliaeetus leucocephalus*), Colorado squawfish (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail chub (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). No other endangered, threatened, or proposed wildlife or plant species are expected to be affected by the proposed project. The American peregrine falcon (*Falco peregrinus anatum*) may occasionally fly near the project area during migration, but populations or habitats of this species would not be affected by the proposed project. Four Candidate (C2) species which could also be affected by reservoir expansion are not addressed by this Biological Assessment but are discussed in appropriate sections of the EIS prepared for the project.

This biological assessment addresses the Forest Service's preferred alternative for reservoir expansion and ensures compliance with the provisions of the Endangered Species Act of 1973, P.L. 93-205 (87 Stat. 884), as amended.

Project Location and Description

The proposed project is located just west of the Continental Divide along the Park Range in north-central Colorado and would consist of increasing the storage capacity of the existing Fish Creek Reservoir. The project site is located approximately 7 air miles east of Steamboat Springs, Colorado on National Forest land under the jurisdiction of the Hahns Peak Ranger District of the Routt National Forest.

Geographically, the reservoir site lies along the upper portions of the Park Range which forms the western boundary of North Park. The area is characterized by high-elevation low, rolling, and variably broken hills and small mountain peaks dissected by generally westerly trending drainages. These drainages are primarily low volume perennial streams with their origins in high elevation wetlands. They join at various locations to form the more substantial Fish Creek which cascades down the western edge of the range until reaching the Yampa River. Elevations in the project area range from approximately 9,800

feet immediately west and downslope of the existing dam to nearly 10,000 feet on the east side of the project area.

The proposed project would involve deepening the reservoir basin in some areas and raising the existing level of the two dams by approximately 18 feet which would allow inundation of an additional 50 acres of land. At present, the reservoir occupies 90 acres and has a capacity of 1,842 acre-feet. The expansion project would provide an estimated additional 2,280 acre-feet of storage capacity. Implementation of the project would involve conventional dam construction techniques, development of new roads and borrow areas, and upgrades of existing roads within the project area.

The reservoir expansion project area occurs within the breeding range of the federally listed endangered bald eagle. None of the four federally listed endangered fish species occur on or near the project area, but the USFWS considers any action that could result in a net water depletion in the upper Colorado River Basin a negative impact to these fish species and their habitats.

Risk Assessment Process

Information regarding the habitat requirements of listed species and their distribution on or near Fish Creek Reservoir was obtained by review of published literature on the biology of these species. Field surveys were conducted in September, 1992 to evaluate the potential presence of suitable habitat within the project area for listed species (Cedar Creek Associates, Inc. 1992).

The following documents were the principal information sources reviewed to assess the risk of the proposed reservoir expansion adversely affecting Threatened, Endangered, or Proposed Species.

- Bald Eagle: Green (1985), USFWS (1983)
- Colorado Squawfish: Behnke and Benson (1983), Torres et al. (1978), Tyus and Karp (1989), USFWS (1991), and Woodling (1985)
- Bonytail - Behnke and Benson (1983), Torres et al. (1978), Tyus and Karp (1989), USFWS (1990a), and Woodling (1985)
- Humpback chub - Behnke and Benson (1983), Torres et al. (1978), Tyus and Karp (1989), USFWS (1990b), and Woodling (1985)
- Razorback sucker - Behnke and Benson (1983), Torres et al. (1978), Tyus and Karp (1989), and Woodling (1985)

This Biological Assessment followed a four step process to identify threatened and endangered species potentially affected by the proposed project and evaluate impacts the project may have on those species.

1. Identification of species of concern from a list of threatened, endangered, and proposed species provided by the USFWS.

2. Review of existing information and identification of known or potential habitat on or near the project area.

3. Field reconnaissance to further refine determination of the occurrence of threatened and endangered species or potential habitat within the project area.

4. Evaluation of potential project-related impacts on threatened and endangered species or critical habitats.

Species Status Descriptions

Bald Eagle (Endangered). The range of the bald eagle encompasses most of the North American Continent. Major breeding areas are associated primarily with coastal areas and large inland lakes and rivers. During the fall, thousands of bald eagles from Alaska and Canada migrate to the lower 48 states and winter there from October through March. Bald eagles occur primarily as wintering birds in Colorado, and wintering populations are known to occur along the Yampa and Colorado rivers. A few nesting records also exist for the state (Green 1985).

Historic (1930s - 1960) reductions in bald eagle reproductive success were linked to the ingestion of prey contaminated with DDT and other chlorinated hydrocarbons used extensively in pesticides (Green 1985). Human disturbance of nest sites is also considered a major factor in the reduction of reproductive success.

Habitat for bald eagles consists of secure nesting sites, diurnal perches, winter roosts, and foraging areas usually associated with large lakes or rivers. Nesting habitats preferred by bald eagles are multi-layered, mature or old-growth forest stands removed from human disturbance and in shoreline areas adjacent to open water (USFWS 1983). Important stand characteristics include large trees and snags which provide sites for nests and perches. Preferred wintering areas are usually near open water portions of major rivers or reservoirs where bald eagles feed on fish or waterfowl. However, bald eagles also will hunt over upland areas with little or no water if other food sources (e.g., rabbits or deer carrion) are readily available (Green 1985).

Late spring snow and ice cover on Fish Creek Reservoir makes the area unsuitable for nesting and obtaining prey during the early portion of the nesting season. Bald eagles may occasionally wander over the area during the winter months, but they are not expected to use the project area for any extended periods because of heavy snow cover and the fact that Fish Creek Reservoir freezes over.

Colorado Squawfish (Endangered). The Colorado squawfish is endemic to the Colorado River basin and occurred historically in Colorado, Wyoming, Utah, New Mexico, Arizona, Nevada, and California in the main stem channels of the Colorado, Gunnison, White, Yampa, Little Snake, San Juan, Dolores, Uncompahgre, Animas, Green, Duchesne, Gila, Salt, and Verde Rivers (USFWS 1991). The current distribution of this species is restricted primarily to the lower reaches of the Green, Yampa, White,

Colorado, and Gunnison rivers (USFWS 1991). Adults are known to winter in the Yampa River as far upstream as Craig, Colorado.

Colorado squawfish are adapted to rivers with seasonally variable flow, high silt loads, and turbulence. Adults prefer eddies, pools, and other areas adjacent to the main current flow in big, deep water. Young squawfish inhabit quiet, shallow backwater areas off main river channels over silt and sand bottoms. Tagging and telemetry studies indicate that Colorado squawfish move long distances from spawning areas in the mainstem Green River to feeding and overwintering areas in the Yampa, White, and Duchesne rivers. These studies suggest a net upstream movement of adult and juvenile squawfish from the Green River into the Yampa River. There also appears to be downstream movement of larval squawfish from the Yampa River to the Green River (USFWS 1991). The quantity and timing of flow from the Yampa River into the Green River has been implicated with the reproductive success of squawfish in downstream areas of the Green River. Young-of-the-year Colorado squawfish were not collected in known nursery areas in the Green River during a dry year when typical high spring flows in the Yampa River were not reached (USFWS 1991).

Limiting factors for Colorado Squawfish have been summarized by Tyus and Karp (1989) as follows. High spring flows, along with increasing water temperatures are necessary for the initiation of spawning migration. Decreasing flows and warming river temperatures in early and mid-summer are necessary for successful spawning and downstream transport of drifting larvae. Low flows in late summer and fall are correlated with availability of nursery habitat and young fish abundance and growth. A stable base-flow is necessary for maintenance of winter habitats.

Causes for the decline of the Colorado squawfish are not completely understood, but alterations in natural flow patterns due to dams and diversions are cited as contributing factors (Woodling 1985). River waters downstream of reservoirs exhibit colder water temperatures and lower sediment loads than those occurring prior to reservoir development. Also the natural cycle of spring flood and late summer drought has been replaced by stable discharges, and seasonal fluctuations are less significant than fluctuations related to variable demands for irrigation water and hydroelectric power. Channelization below dams has reduced the amount of shallow, backwater habitats preferred by squawfish for nursery and resting areas. Dams also have blocked historic migration routes. Additionally, competition with introduced, non-native fishes has been implicated in the decline of Colorado squawfish and other native species.

Bonytail Chub (Endangered). Bonytail chubs were formerly found in larger river environments of the entire Colorado River basin from Wyoming to Mexico (USFWS 1990a). Until the construction of large dams, this fish was probably the most abundant species in the main river channels of the Colorado and Green rivers (Behnke and Benson 1983). Recently, bonytail chubs have only been collected from

the Black Rocks area of the Colorado River near the Colorado/Utah border (Woodling 1985). Little is known of the habitat requirements of the bonytail chub, but it seems to prefer eddies and pools and avoids the swift current of main channels areas (USFWS 1990a). A radio-tracking study of adult bonytail chubs introduced into the upper Green River in 1988 and 1989 is expected to yield additional habitat use information (Tyus and Karp 1989).

Hybridization with other *Gila* species and cold water releases from dams are believed to be the primary reasons behind the decline in bonytail chub populations (Woodling 1985).

Humpback Chub (Endangered). The historical distribution of the humpback chub probably included the swift, deepwater habitats within canyon portions of the Colorado River, Green River, and two Green River tributaries, the Yampa and White rivers (USFWS 1990b). Present populations of the humpback chub in Colorado occur in the Yampa River in Dinosaur National Monument, the Green River in Dinosaur National Monument and in Desolation and Gray canyons, the Colorado River in Marble and Grand canyons and between Palisade and Black Rocks, and the mouth of the Little Colorado River (USFWS 1990b). Greatest numbers have been found in the Black Rocks area of the Colorado near the Utah/Colorado border.

The humpback chub has been collected primarily in canyon portions of rivers characterized by fast currents and deep channels (USFWS 1990b). Adjacent shallower areas and eddies within these canyons appear to be important for adult humpbacks (Tyus and Karp 1989). Young-of-the-year prefer shallow habitats with little current over silt substrate (USFWS 1990b). As with the Colorado squawfish, spring peak flows are important to the reproductive success of humpback chub because spawning occurs in shoreline eddy habitat shortly after peak runoff (Tyus and Karp 1989).. The extent of suitable spawning habitat is greatest during spring runoff and is reduced rapidly with decreasing summer flows.

Causes for this species' decline have been linked to reductions in flow, cold water releases from dams, hybridization with other *Gila* species, and competition with introduced species (Tyus and Karp 1989).

Razorback Sucker (Endangered). Historically the range of the razorback sucker was similar to that of the Colorado squawfish, large river habitats in the Colorado River basin from Mexico to Wyoming. In Colorado the razorback sucker has recently only been found in the lower, mainstem Colorado, Gunnison, Yampa, and Green rivers (Woodling 1985). In the upper Colorado River basin, razorback suckers disappeared from the Green River above the mouth of the Yampa River after the completion of Flaming Gorge Dam and the release of cold water (Behnke and Benson 1983).

The razorback sucker is a large river species found in habitats with strong currents and backwater areas. Spawning of razorback sucker has been documented in the lower Yampa River and the upper Green River below the mouth of the Yampa River. Spawning individuals were captured over cobble and gravel bar substrates during the period of increased flow associated with the highest spring runoff (Tyus and Karp 1989).

Reasons for the decline of this species are not fully understood. Reproductive failure due to dam and diversion related changes in water temperature, flows, and channel characteristics are believed to be contributing factors (Woodling 1985). Documented predation of razorback sucker young and eggs by non-native fish species such as carp and catfish has also been cited as a contributing factor (Behnke and Benson 1983).

Determination of Effects and Mitigation

The proposed expansion of the Fish Creek Reservoir would not effect bald eagles or important habitats. No bald eagle nesting habitat or suitable foraging areas exist in the vicinity of the project area. Suitable bald eagle winter habitat exists along the Yampa River and wintering birds could occasionally wander near the project area. However, high elevation, in combination with heavy snow cover and the lack of open water in the reservoir during the winter months, preclude any bald eagle winter use of the project area.

Since none of the four endangered fish species occur on Routt National Forest lands, there would be no direct project impacts on populations of these species. Indirect impacts could result, however, from downstream changes in flow regimes or water depletion to the mainstem Yampa River. The USFWS believes that major causes for the decline of the four endangered fish species include the effect of impoundments and water depletion from the Colorado River and its tributaries.

Enlargement of the Fish Creek Reservoir would result in minor reductions in the release of water into Fish Creek and, correspondingly, into the Yampa River during the spring fill period. In addition, peak outflows from the reservoir during the spring runoff period would be delayed from previous release regimes as a result of the increased capacity of the reservoir. The existing reservoir fills to capacity by late May or early June. With the proposed reservoir expansion, filling to capacity would be delayed until late June or early July. As a result, release of peak spring flows would be delayed for approximately 1 month. Also, the magnitude of spring releases would be somewhat less in low flow years since peak flows usually occur from late May through mid-June. In high flow years, peak spring flows continue into early July.

An increase in reservoir size from approximately 90 surface acres to 140 acres also would increase evaporative water losses from the reservoir. Based on an estimate of evaporative water losses ranging

from 45 to 150 acre-feet per year for the existing reservoir, evaporative water losses would increase to a range of approximately 70 to 230 acre-feet per year for the enlarged reservoir. These ranges are based on estimates of evaporative water losses of 6 to 20 inches per year for the project area, however, no site-specific data are available for the site.

Projected future increased consumption of water in the Steamboat Springs area will also eventually decrease the amount of water available from the Fish Creek drainage to the Yampa and Colorado rivers, but this decrease will eventually occur whether or not Fish Creek Reservoir is expanded.

After the early spring period, flows released into Fish Creek for the remainder of the year would be more consistent. More consistent releases would result from greater control over releases through the redesigned outlet structure, remote operator control of the outlet, and a minimum instream flow agreement. As a result of the minimum instream flow agreement, 200 ac-ft of the proposed reservoir expansion would be reserved for maintaining a minimum instream flow of at least 2 cfs in lower Fish Creek.

Because expansion of Fish Creek Reservoir would result in a minor depletion of spring water releases into the upper Colorado River basin, and cause minor alterations in flow regimes to the Yampa River, it has been determined that the proposed action May Affect, but is not likely to adversely affect downstream populations of the Colorado squawfish, humpback chub, bonytail chub, or razorback sucker.

References Cited

Behnke, R.J. and D.E. Benson. 1983. Endangered and threatened fishes of the upper Colorado River Basin. Cooperative Extension Service, Colorado State University, Fort Collins, Colorado. Bulletin 503A. 38 pp.

Cedar Creek Associates, Inc. 1992. Wildlife technical memorandum, Fish Creek Reservoir expansion project. Unpublished report submitted to the Routt National Forest. November, 1992. 23 pp. + appendix.

Green, N. 1985. The bald eagle. pp. 509-531 In: DiSilvestro, R. L. (ed.). 1985. The Audubon wildlife report. The National Audubon Society, New York. 671 pp.

Rose, K. 1992. Assistant Colorado State Supervisor, USFWS, Grand Junction, Colorado. Letter to S.B. Reed., District Ranger, Routt National Forest, Steamboat Springs, Colorado. May 19, 1992.

Torres, J, S. Bissell, G. Craig, W. Graul, and D. Langlois. 1978. Essential habitat for threatened or endangered wildlife in Colorado. Wildlife Management Section, Colorado Division of Wildlife. 84 pp.

Tyus, H.M. and C.A. Karp. 1989. Habitat use and streamflow needs of rare and endangered fishes, Yampa River, Colorado. U.S. Fish and Wildlife Service, Biological Report 89(14). 27 pp.

U.S. Fish and Wildlife Service (USFWS). 1983. Northern states bald eagle recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. 117 pp.

U.S. Fish and Wildlife Service (USFWS). 1990a. Bonytail chub revised recovery plan. Prepared in cooperation with the Colorado River Fishes Recovery Team for Region 6. U.S. Fish and Wildlife Service, Denver, Colorado. 35 pp.

U.S. Fish and Wildlife Service (USFWS). 1990b. Humpback chub revised recovery plan. Prepared in cooperation with the Colorado River Fishes Recovery Team for Region 6. U.S. Fish and Wildlife Service, Denver, Colorado. 41 pp.

U.S. Fish and Wildlife Service (USFWS). 1991. Colorado squawfish revised recovery plan. Prepared in cooperation with the Colorado River Fishes Recovery Team for Region 6. U.S. Fish and Wildlife Service, Denver, Colorado. 52 pp.

Woodling, J. 1985. Colorado's little fish. Colorado Division of Wildlife, Denver. 77 pp.

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GLOSSARY

GLOSSARY

acre-foot (AF)
The amount of water which covers an acre of land to a depth of one foot; equal to 325,827 gallons.

ACHP
Advisory Council on Historic Preservation

ADT
Average daily traffic. Measured as a one-way trip (a round-trip is two one-trips).

affected environment
A physical, biological, social, and economic environment within which human activity is proposed.

alluvium
Material, including clay, silt, sand, gravel, and mud, deposited by flowing water.

alternatives
A choice of two or more things; for NEPA purposes alternatives to the Proposed Action must be examined in an EIS. The discussion of alternatives must "sharply [define] the issues and [provide] a clear basis for choice...by the decision maker and the public." (40 CFR 1502.14).

ambient
The environment as it exists at the point of measurement and against which changes (impacts) are measured.

animal unit month (AUM)
The amount of forage required by one cow and one 6-month old calf, or their equivalent, for one month. Approximately 1,000 pounds of air-dried feed.

aquatic
Growing, lining in, frequenting or taking place in water; in this EIS, used to indicate habitat, vegetation and wildlife in freshwater.

anthesis
The period or act of expansion of flowers.

aquifer
A zone, stratum or group of strata acting as a hydraulic unit that stores or transmits water in sufficient quantities for beneficial use.

available water capacity
Capacity of a soil profile for storing water in a form available to plants.

background
(Visual distance zone.) The distant part of a landscape. The seen or viewed area located from 3 to 5 miles to the horizon from the viewer.

base flow
A sustained or fair-weather flow of a stream.

berm
An earthen structure, generally several feet high, which acts as a barrier to make it difficult for a vehicle to cross, or which redirects the flow or traffic or water.

Best Management Practices (BMP)
Management actions that are designed to maintain water quality by preventative rather than corrective means.

big game
Large animals hunted, or potentially hunted, for sport.

biomass
The amount (weight or mass) of living material.

biota
All of the living material in a given area; often refers to vegetation.

BOD
Biological Oxygen Demand - The quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time and temperature.

borrow area
Rock quarry; earthen construction material source area such as sand and gravel or topsoil taken from specific area for use in construction or reclamation.

Bureau of Land Management (BLM)
The agency of the United States Government, under the Department of the Interior, responsible for administering the public lands of the United States.

carrying capacity
The maximum population number that can be sustained under existing conditions.

CDWR
Colorado Division of Water Resources

CEQ
Council on Environmental Quality - A body established by the National Environmental Policy Act (NEPA) to draft regulations for implementing and monitoring NEPA.

CFR
Code of Federal Regulations.

cfs
Cubic feet per second, 1 cfs equals 448.33 gallons per minute.

CGS
Colorado Geological Survey

chronically
Continually and repeatedly over a long period of time.

City
City of Steamboat Springs, Colorado

CNAO
Colorado Natural Areas Office

COE
U.S. Army Corps of Engineers

coarse fragments
That portion of the soil larger than 2mm including gravels, cobbles, rocks and boulders.

colluvial
Soil material that has moved downhill and has accumulated on lower slopes and at the bottom of a hill consisting of alluvium in part and also containing angular fragments of the original rocks, i.e. cliff and avalanche debris.

colluvium
Soil material or rock fragments moved down slope by gravitational force in the form of creep, slides, and local wash.

Colorado
State of Colorado

contrast
The effect of striking difference in form, line, color, or texture of a landscape's features.

Commissioners
Routt County Commissioners

County
Routt County

cover
Living or non-living material (e.g., vegetation) used by fish and wildlife for protection from predators, to ameliorate conditions of weather, or reproduce: The proportion of the ground occupied by a perpendicular projection to the ground from the outline of the aerial parts of the members of a plant species.

criteria
Date and information which are used to examine or establish the relative degrees of desirability among alternatives or the degree to which a course of action meets an intended objective.

CRWCD
Colorado River Water Conservation District

cumulative impacts
Combined impacts of the past, present and reasonable foreseeable future actions. For example, the impacts of a proposed timber sale and the development of a mine together result in cumulative impacts.

CWCB
Colorado Water Conservation Board

DEIS
Draft Environmental Impact Statement, see EIS.

demography
A statistical study of the characteristics of human populations with reference to size, density, growth, distribution, migration and effect on social and economic conditions.

density
The number of individuals in a given area. Expressed per unit area.

depletion
Use of water in a manner that makes it no longer available to other users in the same system.

direct impacts
Impacts which are caused by the action and occur at the same time and place.

discharge
The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute, or cubic meters per second.

diversion
Removing water from its natural course or location, or controlling water in its natural course or location, by means of a ditch, canal, flume, reservoir, bypass, pipeline, conduit, well, pump, or other structure or device.

diversity
An expression of community structure. High if there are many equally abundant species; low if only a few equally abundant species.

DOW
Colorado Division of Wildlife

earthquake
Sudden movement of the earth resulting from faulting, volcanism, or other mechanisms within the earth.

edaphic
Pertaining to soils.

effects
"Effect" and "impact" are synonymous as used in this report. Direct or primary impacts are those caused by the project and occur at the same time and place. Indirect, or secondary, effects are those that result from the project that occur later in time or farther removed in distance or time, but are still reasonably forcibly.

EIS
Environmental Impact Statement - Means a detailed written statement as required by section 12(2)(C) of the National Environmental Policy Act (40 CFR 1508.11). An analytical document prepared under the National Environmental Policy Act (NEPA) that portrays potential impacts to the human environment of a Proposed Action and its possible alternatives. An EIS is developed for use by decision makers to weigh the environmental consequences of a potential decision.

endangered
Any species which is in danger of extinction throughout all or a significant portion of its range.

environment
The physical conditions that exist within the area that will be affected by a proposed project, including land, water, minerals, flora, fauna, and objects of historical or aesthetic significance. The area involved shall be the area in which significant effects would occur either directly or indirectly as a result of the project. The "environment" includes both natural and man-made conditions.

EPA
Environmental Protection Agency.

ephemeral stream
A stream or portion of a stream that flows only in direct response to precipitation. Such flow is usually of short duration.

epicenter
The part of the earth's surface directly above the focus or origin, of an earthquake.

erosion
The wearing away of the land surface by running water, wind, ice or other agents.

°F
Degrees Fahrenheit

FAC
Facultative Plants: plants with a similar likelihood of occurring in uplands or wetlands (33 to 67%)

FACU
Facultative Upland Plants: plants which sometime occur in wetlands but occur most often (67 to 99%) in uplands.

FACW
Facultative Wetland Plants: plants which sometimes occur in uplands but occur most often (67 to 99%) in wetlands.

fan
Rock and soil material deposited at the toe of a slope by the action of fluvial and gravitational forces.

fault
A displacement of rock along a sheer surface.

feasible
Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

fines
Fine particulate matter; specifically particles less than 4.0 mm in diameter.

fishery
All activities related to human harvest of a fisheries resource.

flaggy
A term describing a soil texture indicating the presence of flat coarse fragments form 5 to 38 cm long.

floodplain
Low land and relatively flat areas joining streams, rivers, and lakes which are periodically inundated by overbank flows of water.

fluvial
Of or relating to a stream or river.

forb
Broad-leafed, small plants composed of soft tissue; not woody material.

foreground
(Visual distance zone.) a term used in visual management to describe the area immediately adjacent to the observer, usually within 1/4 to 1/2 mile.

Forest Service
USDA Forest Service

Forest Supervisor
Routt National Forest Supervisor

form
The mass or shape of an object, which appears unified; often defined by edge, outline, and surrounding space.

frequency
The number of samples in which a plant or animal species occurs divided by the total number of samples.

geomorphic
Pertaining to the form of the surface of the earth.

geotechnical
A branch of engineering that is essentially concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

glacial drift
Glacial materials deposited directly by ice with little or no transportation by water.

gpd
Gallons per day.

gpm
Gallons per minute.

grade
A slope stated as so many feet per mile or as ft/ft (%).

groundwater
Water found beneath the land surface,in the zone of saturation below the water table.

growth media
All materials; including topsoil, specified soil horizons, vegetative debris, and organic water, which are classified as suitable for stockpiling and reclamation re-topsoiling.

habitat
The natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions.

hazardous waste
A waste is considered hazardous by the EPA if it exhibits one or more of these characteristics; ignitability, corrosivity, reactivity, toxicity. These are listed in 40 CFR 261.3 and 40 CFR 171.8.

heterogeneous
Not uniform in structure or composition.

hydraulic conductivity
A measure of the ability of rock or soil to permit the flow of ground water under a pressure gradient; permeability.

hydrologic system
All physical factors, such as precipitation, stream flow, snowmelt, ground water, etc., that effect the hydrology of a specific area.

ID Team
Interdisciplinary Team - The interdisciplinary team is comprised of personnel who collectively represent two or more areas of specialized technical knowledge about natural resources management applicable to the area being planned. The team will consider problems collectively, rather than separate concerns along disciplinary lines. This interaction will ensure systematic, integrated consideration of physical, biological, economic, and other sciences.

impermeable
Property of a substance that inhibits passage of fluids through its mass.

impoundment
The accumulation of any form of water in a reservoir or other storage area.

incized
A narrow, steep-walled valley caused by erosion.

increment
The amount of change from an existing concentration or amount; such as air pollutant concentrations

indigenous
Originating, developing, or produced naturally in a particular land, region, or environment; native.

indirect impacts
Impacts which are caused by the action and are later in time or farther removed in distance, but are still reasonable foreseeable.

inert
A substance that is chemically unreactive; not effecting any substance it comes in contact with.

infiltration
The movement of water or some other fluid into the soil through pores or other openings.

infiltration galleries
Horizontal wells utilized to collect alluvial groundwater; for the City and Mt. Werner, the infiltration galleries (which they sometimes call well fields) are utilized as a back-up water supply.

infrastructure
The underlying foundation or basic framework; substructure.

intermittent stream
A stream that does not contain water year-round

interstitial
Occupying the spaces between sediment particles.

isothermal
Having equal temperatures.

jurisdictional wetland
A wetland area delineated and identified by specific technical criteria, field indicators and other information for purposes of public agency jurisdiction. The public agencies which administer jurisdictional wetlands are the Fish and Wildlife Service, Army Corps of Engineers, Environmental Protection Agency and the Soil Conservation Service.

key viewpoint
The point(s) commonly in use or potentially in use where the view of a management activity is the most disclosing. The location which provide the means of studying the visual impact of alternatives to the landscape.

landform
A natural landscape that exists as a result of wind, water, or geologic activity.

landscape
The sum total of the characteristics that distinguish a certain area on the earth's surface from other areas. These characteristics are a result not only of natural forces but of human occupancy and use of the land.

lead agency
The public agency that has the principal responsibility for carrying out or approving a project.

line
The path that the eye follows when perceiving abrupt differences in form, color, or texture. In the landscape, ridges, skylines, structures, changes in vegetation, or individual trees and branches may be perceived as line.

lineament
A topographic line that is structurally controlled (faults, jointing, etc.). Lineaments are studied especially on aerial photographs.

lithic
Made from stone, particularly as applied to the production and manufacture of stone tools.

long-term impacts
Impacts that result in permanent changes to the environment.

management area
An area of land used in planning that consists of similar analysis areas, has one prescription assigned, and may not be contiguous.

middleground
(Visual distance zone.) The space between the foreground and the background in a picture or landscape. The area from 1/2 to 3 to 5 miles from the viewer.

migratory
Moving form place to place, daily or seasonally.

minimum in-stream flow
A set amount of water to be maintained in a water course for the purpose of reasonably maintaining the environment.

mitigation measure
There are several meanings of mitigate: Avoid the impact by not taking action. Minimize the impact by limiting the degree of magnitude of the action and its implementation. Rectify the impact by repairing, rehabilitating, or restoring the affected environment. Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action. Compensate for the impact by replacing or providing substitute resources, or by enhancing the value of an adjacent existing environment.

modification
A visual quality objective meaning man's activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

monitoring
A watching, observing or checking, in this instance, a continuing testing of specific environmental parameters and of project waste streams for purposes of comparing with permit stipulations, pollution control regulations, mitigation plan goals, etc.

MOU
Memorandum of Understanding.

Mt. Werner
Mt. Werner Water and Sanitation District

multiple use
The management concepts under which National Forest lands are managed. It involves the management of resources in combinations that will best serve the public.

National Forest
Routt National Forest

NEPA
The National Environmental Policy Act of 1969 - National charter for protection of the environment. It establishes policy, sets goals and provides means for carrying out the policy. 40 CFR 1500-1508 are the regulations for implementing the act.

NEPA Process
All measures necessary to comply with the requirements of section 2 and Title I of NEPA.

NPDES
National Pollutant Discharge Elimination System - A program authorized by sections 318, 402 and 405 of the Clean Water Act, and implemented by regulations 40 CFR 122. NPDES program requires permits for the discharge of pollutants from any point source into waters of the United States.

OBL
Obligate Wetland Plants: plants which almost always occur (99%) in wetlands.

parent material
Unconsolidated organic and inorganic mineral material in which soils form.

partial retention
A visual quality objective which in general means man's activities may be evident but must remain subordinate to the characteristic landscape.

percolation/infiltration
The act of water seeping or filtering through the soil without a definite channel.

permeability
The property or capacity of a porous rock, sediment, or soil for transmitting a fluid; it is a measure of the relative ease of fluid flow under unequal pressure.

pH
Symbol for the negative common logarithm of the hydrogen ion concentration (acidity) of a solution. The pH of 7 considered neutral. A pH number below 7 indicates acidity and a pH value above 7 indicates alkalinity or a base.

physiography
A description of the features and phenomena of nature.

piezometer
A device for measuring moderate pressures of liquids.

PMF
Probable Maximum Flood - A statistically determined flood event.

point source
Stationary sources of potential pollutants. In terms of mining, some examples of point sources are crushing and screening equipment, conveyor and pond outlet pipes.

pollution
Human-caused or natural alteration of the physical, biological, and radiological integrity of water, air, or other aspects of the environment producing undesired effects.

porosity
The percentage of the bulk volume of rock or soil that is occupied by interstices, whether isolated or connected.

potable water
Suitable, safe, or prepared for drinking.

potentiometric surface
Surface to which water in an aquifer would rise by hydrostatic pressure.

prehistoric
relating to the times jus preceding the period of recorded history.

priority pollutant
Toxic aqueous pollutants specified as a particular concern in the Clean Water Act; EPA sets limits for discharge of these pollutants.

pristine
Pertaining to pure, original, uncontaminated conditions.

probable maximum flood
See PMF.

project
The whole of an action, which has a potential for resulting in a physical change in the environment.

Proposed Action
A description of the project as proposed by the project proponent in the Special Use Permit application.

PRVs
Pressure Reducing Valves

public scoping
Giving the public the opportunity for free, unhampered, speaking or writing concerning the intentions, activity, or influence of a project on the community, environment, personal, or anything relative.

raptor
Bird of prey, including eagles, hawks, falcons, and owls.

RCC
roller compacted concrete

RCRA
Resource Conservation and Recovery Act

recharge
Absorption and addition of water to the zone of saturation.

reclamation
Returning disturbed land to a form and productivity that will be ecologically balanced and in conformity with a predetermined land management plan.

Reclamation Plan
A document that details the specific measures to be taken by the project proponent to reclaim the project lands during construction and after prject completion.

resident
A species, which is found in a particular habitat for a particular time period (i.e. winter resident, summer resident, year-round) as opposed to those found only when passing through on migration.

residuum
Soil material formed by rock weathering in place.

richter scale
A numerical (logarithmic) measure of earthquake intensity.

rills
A channel or groove made by a small stream.

riparian
A type of ecological community that occurs adjacent to streams and rivers. It is characterized by certain types of vegetation, soils, hydrology and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

riprap
a layer of large, broken rock placed together irregularly to prevent erosion of embankments, causeways, or other surfaces.

ROD
Record of Decision - A document which discloses the decision on a major federal action and the reasons why the decision was made.

ROS
Recreational Opportunity Spectrum - Used in describing potential recreational uses of an area.

runoff
Precipitation that is not retained on the site where it falls, not absorbed by the soil; natural drainage away from an area.

RVD
Recreation Visitor Days

safety factor
A safety factor is a ratio of resisting forces to driving forces. By determining a structure's safety factor, a numerical index of stability is obtained.

scenic quality
The degree of harmony, contrasts, and variety within a landscape; the overall impression retained after driving through, walking through, or flying over an area of land and/or water.

scoping
The procedures by which the Led Agencies identifies the issues and determines the extent of analysis necessary for the Environmental Impact Statement

sedentary organisms
Not migratory; staying in one place; stationary.

sediment
Material suspended in liquid or air; also, the same material once it has been deposited.

sediment basin
A pond, depression, or other device used to trap and hold sediment.

sediment loading
The mass of solid erosion products deposited by or carried in water or air.

sediment trap
A facility (e.g., an excavation basin or pond) or quiet water where suspended particulates can settle to the bottom, reducing sediment transport downstream.

seismicity
The likelihood of an area being subject to natural earthquakes; the relative frequency, magnitude, and kind of natural earthquakes.

sensitive species
A plant or animal listed by the State or Federal agency as being of environmental concern; includes but is not limited to threatened and endangered species.

sensitivity level
A particular degree of measure of viewer interest in and concern for the scenic quality of the landscape.

settling ponds
Structures constructed by excavation and/or by building an embankment whose purpose is to retain water and allow for settlement of fines (TSS) and reduction in turbidity.

SHPO
State Historic Preservation Office

short-term impacts
Impacts occurring during project construction and operation, and ceasing upon project closure reclamation.

significant effect
A substantial,or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, water, minerals, flora, fauna, and objects of historic or aesthetic significance.

significant issues
Of all the issues and concerns raised during the scoping process for an environmental impact statement, certain of those issues are determined to be "significant" by the lead public agency. Determining which issues are significant, and thus meriting detailed study in the EIS, is the final step of the scoping process and varies with each project and each location.

siltation
The deposition or accumulation of silt or unconsolidated very fine grained soil particles.

slumping
Sliding of a mass of unconsolidated sediment down-slope. The sediment moves as a unit mass and often becomes a turbidity flow. Slumping may be triggered by slope instabilities or by earth movements.

soil horizon
A layer of soil material approximately parellel to the land surface differing fromn adjacent genetically related layers in phgysical, chemical and biological properties.

soil productivity
The natural capacity of a soil to produce a specified plant or sequence of plants under a specified system of management.

soil profile
A vertical section of the soil through all its horizons and extending into the parent material or to a depth of 60 inches.

solid waste
Garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting form industrial, commercial, mining, and agricultural operations, and from community activities.

Spill Prevention and Response Plan
A contingency plan for avoidance of, containment of and response to hazardous materials spills or leaks.

Special Use Permit
Forest Service Special Use Permit

stereoscopic
the process of viewing an object from tow locations to produce a three dimensional image, especially when a stereoscope is used to view aerial photograph pairs.

streamflow
The discharge (flow of water) in a natural channel.

stream gradient
The rate of fall or loss of elevation over the physical length of a segment or total stream usually expressed in feet per foot (%)

succession
Changes in the plant communities composing an ecosystem as the ecosystem evolves from one type to another, e.g. wetlands becoming grassy meadows.

synchronous
Recurring or operating at exactly the same periods.

taxonomy
The science of the classification and arrangement, according to relationships, of living organisms.

TDS
Total dissolved solids - As it applies to sediments in streams.

terrestrial
Of or relating to the earth, soil, land; an inhabitant of the earth or land.

texture
The visual manifestation of the interplay of light and shadow created by variations in the surface of an object.

third-party contractor
An independent firm contracted by a government agency to perform work related to a proposed action of another organization; due to the financial and contractual arrangements governing such relationships, the third-party contractor has no financial or other interest in the decision to be reached on the project.

threatened species
A wildlife species officially designated by the Fish and Wildlife Service as having its existence threatened.

topography
A configuration of a surface including its relief.

transect
A long strip or belt of terrain in which all individuals are counted and measured.

transmissivity (coefficient of)
A measure of the ability of an aquifer to transmit water.

TSS
Total suspended solids, as it applies to sediments in streams.

turbidity
Reduced water clarity resulting from the present of suspended matter.

unavoidable effects
Many effects which could occur from the project can be eliminated or minimized by management requirements and constraints and mitigation measures. Effects that cannot be eliminated are identified as unavoidable.

UPA
Obligate Upland Plants: plants which almost always occur (99%) in uplands.

underflow
Movement of water through subsurface material.

understory
A foliage layer lying beneath and shaded by the main canopy of a forest.

USDA
United States Departmemnt of Agriculture

USFWS
United States Fish and Wildlife Service - United States Department of Interior.

USGS
United States Geological Survey.

UYWCD
Upper Yampa Water Conservancy District

variety class
A rating system that classifies the landscape into different degrees of variety. This determines those landscapes which are most important and those which are of lesser value from the standpoint of scenic quality.

visual absorption capability
The physical capacity of a landscape to screen proposed development and still maintain its inherent visual character.

visual management system
The system devised by the USFS in the early 1970's to incorporate visual values into their forest management system. It involves classifying landscapes, determining visual objectives, understanding how much change a landscape can absorb, and mitigating impacts so that visual quality objectives are met.

visual management objectives
Objectives identified by the Forest Service for management of viewsheds.

visual quality objective
Degree of acceptable alteration of the natural landscape. and used by the Forest Service in classifying visual resources of an area.include retention, partial retention, modification.

visual resources
The Forest service manages viewsheds as a resource, establishing specific management objectives for different areas of Forest Service land.

visual sensitivity levels
A three-level rating system used to delineate areas receiving different amounts of exposure (present or potential) to user groups with differing attitudes towards changes in scenic quality. When combined with distance zones and variety class, make up visual quality objectives.

water filtration plant
A water treatment facility that filters water to produce potable water which meets the requirements of the Safe Drinking Water Act.

watershed
The entire land area that contributes water to a particular drainage system or stream.

weathering
The process whereby larger particles of soils and rock are reduced to finer particles by wind, water, temperature changes, and plant and bacteria action.

weir
A device (as a notch in a dam) for determining the quantity of water flowing over it from measurements of the depth of water over the crest or sill, and known dimensions of the device.

wetlands
Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, etc.

wilderness
Land designated by Congress as a component of the National Wilderness Preservation System.

WQCD
Colorado Department of Health - Water Quality Control Division

YVEA
Yampa Valley Electric Association

404 Permit
Section 404 or the Clean Water Act specifies that anyone wishing to place dredged or fill materials into the waters of the United States and adjacent jurisdictional wetlands shall apply to the U.S. Army Corps. of Engineers for approval. A permit issued by the Corps. of Engineers for these activities is known as a 404 permit.

REFERENCES

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ACZ, Inc. 1992a. Dam Safety/Flood Hazard Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

ACZ, Inc. 1992b. Water Resources Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

ACZ, Inc. 1992c. Socioeconomics Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

ACZ, Inc. 1992d. Recreation Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

ACZ, Inc. 1992e. Transportation Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

ACZ, Inc. 1992f. Visual Resource Baseline Technical Report for the Fish Creek Reservoir Expansion EIS.

Algermissen, S.T. 1969. Seismic Risk Studies in the United States. Proceedings of the Fourth World Conference on Earthquake Engineering, Chilean Association of Seismology and Earthquake Engineering Santiago, Chile.

Algermissen, S.T., Perkins, D.M., Thenhaus, P.C., Hanson, S.L., and Bender, B.L. 1982. Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States. U.S. Geological Survey Open File Report 82-1033.

Allen, A. W. 1982. Habitat suitability index models: marten. U.S. Fish and Wildlife Service Biological Report 82(10.11). 9 pp.

America's Great Outdoors (AGO) Presidential Initiative. 1991.

Bailey, A.M. and R.J. Niedrach. 1965. Birds of Colorado. Denver Museum of Natural History. 2 Vol., 895 pp.

Benedict, James B. and Byron L. Olson. 1978. *The Mount Albion Complex*. Center for Mountain Archaeology Research Report. Ward, Colorado.

Birch, Dan. 1992a. City of Steamboat Springs. Personal communication regarding Fish Creek and Long Lake reservoir operations. October 21, 1992.

Birch, Dan. 1992b. City of Steamboat Springs. Letter regarding service area for the EIS analysis September 15, 1992.

Birch, Dan. 1992c. City of Steamboat Springs. Personal communication regarding filtration plant ownership. October 1992.

Birch, Dan. 1992d. City of Steamboat Springs. Personal communication regarding reservoir financing. December 1992.

Birch, Dan. 1992e. City of Steamboat Springs. Memo pertaining to water demands and wastewater loading forecasts. May 3, 1991.

Black & Veatch (B & V). 1988. Report on Revenue Requirements, Costs of Service, and Rates for Water and Sewer Service - City of Steamboat Springs, Colorado. February 1988.

Bomba, J., Davis, S., Freeman, T., Higgins, R., Mushovic, T., Rompage, A. 1990. Improving Downstream Safety Conditions for Steamboat Springs, EPICS 202-D-1. Fish Creek Reservoir Project.

Brattstrom, B.H. 1962. Thermal control of aggregation behavior in tadpoles. Herpetological 18:38-46.

Byrne, G. 1992. Colorado Division of Wildlife, Glenwood Springs. Personal communication to M. Phelan, Cedar Creek Associates, Inc., Fort Collins, Colorado. Fisher, Lynx & Wolverine Database records for Routt and Jackson counties. October 22, 1992.

Campbell, J.B. 1972. Reproduction and transformation of boreal toads in the Colorado Front Range. Journal Colorado-Wyoming Academy of Science 7:114.

Capital Investment Project Proposal. 1991. U.S.D.A. Forest Service.

Cedar Creek Associates, Inc. (Cedar Creek) 1992a. Wetland Technical Memorandum - Fish Creek Reservoir Expansion Project.

Cedar Creek Associates, Inc. 1992b. Vegetation and Range Technical Memorandum-Fish Creek Reservoir Expansion Project.

Cedar Creek Associates, Inc. 1992c. Wildlife Technical Memorandum, Fish Creek Reservoir Expansion Project. Unpublished report submitted to the Routt National Forest, November, 1992.

Chen and Associates. 1982. Geotechnical Study for Increasing the Height of Two Dams, Fish Creek Reservoir, Routt County, Colorado.

Chubrilo, Jim. 1992. Colorado Department of Health, Water Quality Control Division (CDH-WQCD). Personal communication regarding filtration requirements for groundwater under the influence of surface conditions.

City of Steamboat Springs. 1989. Population Projections.

City of Steamboat Springs. 1991. 1992 Budget.

City of Steamboat Springs. 1992. Emergency Preparedness Plan.

Civil Design Consultants (CDC). 1991. Infiltration Gallery and Yampa River Pump Station Improvements Submittals.

Cobb, Chuck. 1992a. USDA Forest Service, Routt National Forest, North Park Ranger District. Personal communication regarding Forest Service roads. September 1992.

Cobb, Chuck. 1992b. USDA Forest Service, Routt National Forest, North Park Ranger District. Personal communication regarding Forest Service roads. October, 1992.

COE/EPA/FWS/SCS. 1987. Federal Manual for Identifying and Delineating Jurisdictional Wetlands.

Colorado Department of Labor and Employment. Covered Employment and Wages in Colorado by Standard Industrial Classification. 1988 - 1991.

Colorado Department of Local Affairs. 1990 Census.

Colorado Division of Wildlife (CDOW). 1989. Wildlife in danger. Department of Natural Resources, Colorado Division of Wildlife, DOW-R-I-1-89, Denver, Colorado.

Colorado Division of Wildlife - Wildlife Resource Information System - (CDOW-WRIS).

Colorado River Water Conservation District (CRWCD). 1991a. Memorandum regarding evaluation of potential reservoir sites.

Colorado River Water Conservation District. 1991b. Memorandum presenting Summary of Engineering Evaluation of Potential Water Storage Sites in the Yampa River Basin

Colorado River Water Conservation District. 1992. Notes for public meeting in Craig, Colorado regarding Yampa River Basin Alternatives Feasibility Study.

Colorado School of Mines - Epics (CSM - EPICS). 1990. Fish Creek Reservoir Project. Improving Downstream Safety Conditions For Steamboat Springs.

Corps of Engineers (COE). 1987. Corps of Engineers Wetlands Delineation Manual. Department of the Army. U.S. Army Corps of Engineers. Washington, D.C.

DeStefano, S. 1987. The lynx. pp. 411-422 In: DiSilvestro, R. L., W. L. Chandler, K. Barton, and L. Labate (eds.). 1987 Audubon wildlife report. The National Audubon Society, New York, Academic Press, New York.

Dismuke & Dismuke, Inc. (D&D) 1983. Evaluation of Fish Creek Reservoir Enlargement Alternatives.

Dismuke & Dismuke Consultants Inc. 1986. As-built drawing of Long Lake Dam Repair Cross Sections and Access Road Improvements.

Duskin, Nolan. Soil Conservation Service. 1992. Personal communication regarding evaporation data from Fish Creek. October 5, 1992.

Fetcher, John. 1992. MWW&SD. Memorandum concerning the history of the Mt. Werner Water and Sanitation District. October 30, 1992.

Gabos, Lou. 1992. Routt County, Colorado. Personal communication regarding county road maintenance. October 1992.

Gerr, Harold. 1992. Jackson County, Colorado. Personal communication regarding county road maintenance. October 1992.

Hammerson, G.A. 1986. Amphibians and reptiles in Colorado. Colorado Division of Wildlife, Denver.

Hayward, G.D., T. Holland, and R. Escano. 1990. Goshawk habitat relationships. pp. 19-27 In: Warren, N.M. (ed.). 1990. Old-growth habitats and associated wildlife species in the northern Rocky Mountains. USDA Forest Service, Northern Region Wildlife Habitat Relationships Program, R1-90-42.

Holt, Kent. 1992a. Colorado Division of Water Resources. Personal communication regarding Sheraton Golf Course diversion and water rights on Little Fish Creek. October 28, 1992.

Holt, Kent. 1992b. Colorado Division of Water Resources. Personal communication regarding water rights in Water District 6. October 27, 1992.

Holt, Kent. 1992c. Colorado Division of Water Resources. Personal communication regarding Fish Creek Flow Characteristics and Consumptive Use. November 3, 1992.

Holt, Kent. 1992d. Colorado Division of Water Resources. Fish Creek Water Accounting Computer Analysis.

Holt, Kent. 1993. Colorado Division of Water Resources. Personal communication regarding dam classification CWCB stipulations.

Hornocker, M. G. and H. S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Canadian Journal of Zoology 59:1286-1301.

Hydrosphere. 1990. Letter report describing potential reservoir sites for the Yampa Basin Study.

Hydrosphere. 1993. Streamflow Reconstruction at Fish Creek Station Near Steamboat Springs.

IME. 1992. Wetland mitigation plan - Fish Creek Reservoir expansion project. City of Steamboat Springs. Steamboat Springs, Colorado.

Jennings, Calvin H. 1982. Cultural Resources Inventory of the Fish Creek Reservoir Expansion Area, Routt County, Colorado. Laboratory of Public Archaeology, Department of Anthropology, Colorado State University, Fort Collins.

John, T. U. S. Forest Service. Routt National Forest. Steamboat Springs, CO. Personal Communication. October, 1992.

Kaplan, Steven and Rachel. 1982. Cognition and Environment, Functioning in an Uncertain World.

Kirkham, R.M. and Rogers, W.P. 1981. Earthquake Potential in Colorado. Colorado Geological Survey Bull. 43.

Krannich, Richard. 1990. Lake Catamount Sociocultural Assessment; Data Summary Report. Rocky Mountain Social Service. Logan, Utah.

Koehler, G. M., W. R. Moore, and A. R. Taylor. 1975. Preserving the pine marten, management guidelines for western forests. Western Wildlands 12(3):33-36.

Maddaus, William O. 1987. Water Conservation.

Madole, R.F. 1991a. Surficial Geologic Map of the Steamboat Springs 30' by 60' Quadrangle. Grand, Jackson, and Routt Counties, Colorado, U.S. Geological Survey Map I-825.

Madole, R.F. 1991b. Quaternary Geology and Geomorphology in Archaeological Excavations at the Yarmony Pit House Site, Eagle County, Colorado. Bureau of Land Management Colorado Cultural Resource Series No. 31.

Main, Chas. T., Inc. 1980. Phase I Inspection Report, National Dam Safety Program, Fish Creek Dam, Routt County, Colorado.

McCord, C.M. and J.E. Cardoza. 1982. Bobcat and lynx. pp. 728-766 In: Chapman, J.A. and G.E. Feldhamer (eds.). 1982. Wild mammals of North America. Johns Hopkins University Press, Baltimore, Maryland.

Metcalf Archaeological Consultants, Inc. (MAC). 1992. A Class III Cultural Resources Inventory and Evaluative Test Excavations for the Fish Creek Reservoir Expansion, Routt County, Colorado.. October 1992.

Metcalf, M.D. and Kevin D. Black, editors. 1991. Archaeological Excavations at the Yarmony Pit House Site, Eagle County, Colorado.

Mount Werner Water and Sanitation District (MWW&SD). 1992. Laboratory Data Sheets - 1985 to present.

Nash, Merle. 1987. Special-Use Application ad Report, USDA Forest Service.

Peterson, Jeff. 1992. MWW&SD. Personal communication regarding water quality and water system facilities. October 28, 1992.

Psass. 1992. Personal communication regarding the historical value of dams.

Reed, Sherry. 1989. Letter to Merle Nash regarding status of permit application for reservoir site.

Reed, Sherry. 1990. Response to Senator Armstrong's congressional inquiry regarding Merle Nash.

Rocky Mountain News. 1992. *Steamboat Grapples with Growth, Balance*. October 11, 1992.

Rossal Remmen and Cares, Inc. 1990. Routt County Housing Needs Assessment.

Schmitzer, Rob. 1992. U.S.D.A. Forest Service, Routt National Forest, Hahns Peak Ranger District. Personal communication regarding recreational resources and road maintenance.

Schmitzer, Wendy. 1992. U.S.D.A. Forest Service NEPA Coordinator. Personal communication to Steve Viert, Range Ecologist - Cedar Creek Associates, Inc. July, 1992.

Sealing, C. 1992a. Fisheries Biologist, Colorado Division of Wildlife, Grand Junction, Colorado. Personal communication (fisheries survey and stocking data) to M. Phelan, Cedar Creek Associates, Inc., Fort Collins, Colorado. October 14, 1992.

Sealing, C. 1992b. Colorado Division of Wildlife, Grand Junction, Colorado. Personal communication to T. Fratt, U.S. Forest Service, Steamboat Springs, Colorado. November 20, 1992.

Seed, H.B. and Idris, I.M. 1982. Ground Motions and Soil Liquefaction During Earthquakes. Earthquake Engineering Research Institute.

Skinner, J.W. 1992. Colorado Division of Wildlife, Denver, Colorado. Personnel communication (letter dated October 29, 1992) to D. Merriam, Colorado Water Conservation Board, Denver Colorado.

Slemmens, D.B. 1977. State-of-the-Art for Assessing Earthquake Hazards in the United States. U.S. Army Corps of Engineers.

Snowden, Leo. 1992. USDA Forest Service, Routt National Forest, Supervisor's Office - Engineering. Personal communication regarding road conditions and maintenance. October 1992.

Soil Conservation Survey (SCS). 1992. Personal communication with Mr. Benjamin Adams assessing computerized climatological records.

Spencer, W. D., R. H. Barrett, and W. J. Zielinski. 1983. Marten, *Martes americana*, habitat preferences in the northern Sierra Nevada, U.S.A. Journal of Wildlife Management 47:1181-1186.

Steamboat Springs Chamber Resort Association, Economic Development Council. 1992. *Steamboat Springs at a Glance.*

Steamboat Today (Today). 1992. *Local officials eye revisions forced by Amendment 1.* November 9, 1992.

Toolen, J.F. 1992. Colorado Division of Wildlife, Grand Junction, Colorado. Letter to J. Fetcher, Mt. Werner Water and Sanitation District, Steamboat Springs, Colorado. November 9, 1992.

Torres, J, S. Bissell, G. Craig, W. Graul, and D. Langlois. 1978. Essential habitat for threatened or endangered wildlife in Colorado. Wildlife Management Section, Colorado Division of Wildlife.

Tumlison, R. 1987. *Felis lynx*. Mammalian Species 269:1-8.

Tweto, O. 1979. Geologic Map of Colorado. U.S. Geologic Survey.

United States Department of Agriculture (USDA) Forest Service. 1974. National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System. April 1974.

USDA Forest Service, Routt National Forest. 1983. *Routt National Forest Land and Resource Management Plan, 1983.*

USDA Forest Service, Routt National Forest. Unpublished Adopted Visual Quality Objectives Map.

USDA Forest Service. 1988. Environmental Policy and Procedures Handbook (Working Paper).

USDA Forest Service, Routt National Forest. 1990. Lake Catamount Resort Final Environmental Impact Statement. November 1990.

USDA Forest Service, Routt National Forest. 1992a. Draft Recreation Plan for the Routt National Forest.

USDA Forest Service, Routt National Forest. 1992b. Draft Recreation and Travel Management Report for the Fish Creek Reservoir Expansion Proposal. Hahns Peak Ranger District.

USDA Forest Service, Routt National Forest. 1992c. Summary of Potential Actions on Buffalo Pass, Buffalo Pass Capital Investment Project. Unpublished. Hahns Peak Ranger District. July 1992.

United States Department of Interior (USDI). 1985. Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species; Notice of Review. Federal Register 50 (188): 39526-82569.

United States Fish and Wildlife Service. 1984. American peregrine falcon recovery plan (Rocky Mountain/ Southwest population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. U.S. Fish and Wildlife Service, Denver, Colorado. 105 pp.

Vranesh, George. 1991. Colorado Citizens Handbook; Colorado Water: The Next 100 Years.

Woodward-Clyde Consultants (WCC). 1991. Conceptual Design of Enlargement of Fish Creek Reservoir, Steamboat Springs, Colorado.

Woodward-Clyde Consultants. 1992a. Final Investigations for Enlargement of Fish Creek Reservoir, Steamboat Springs,

Woodward-Clyde Consultants. 1992b. Design Criteria for Enlargement of Fish Creek Reservoir. Steamboat Springs, Colorado.

Woodward-Clyde Consultants. 1992c. Dambreak Analysis for Fish Creek Dam Enlargement, Routt County, Colorado.

Zopf, Michael. 1992. Routt County Department of Environmental Health. Personal communication.